

# LIBRARIES AND INFORMATION STORAGE AND RETRIEVAL SYSTEMS

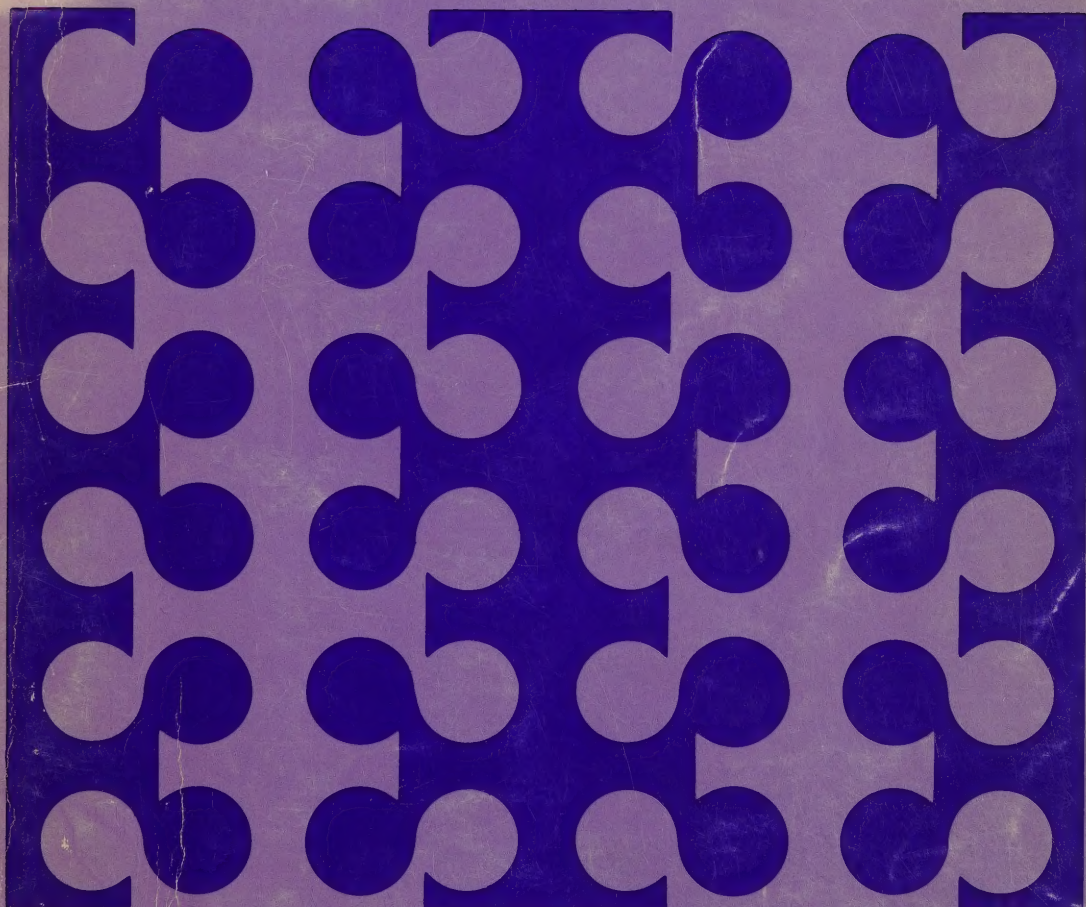
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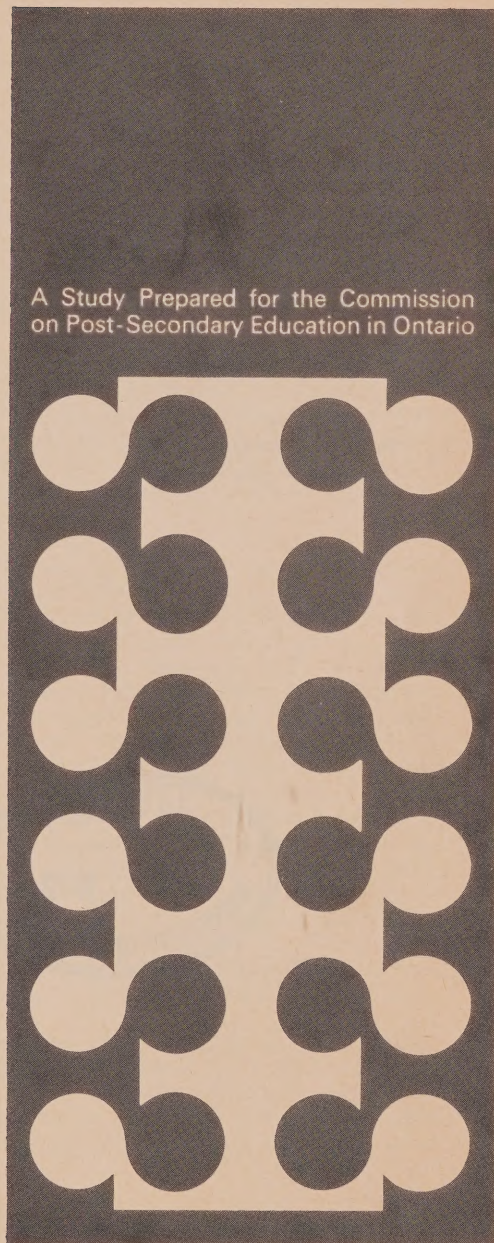
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# LIBRARIES AND INFORMATION STORAGE AND RETRIEVAL SYSTEMS

A Study Prepared for the Commission  
on Post-Secondary Education in Ontario



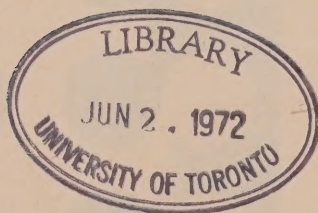
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## Libraries and Information Storage and Retrieval Systems


### Editorial Foreword

The Commission on Post-Secondary Education in Ontario was required by its terms of reference "to consider, in the light of present provisions for university and other post-secondary education in Ontario, the pattern necessary to ensure the further effective development of post-secondary education in the province during the period to 1980, and in general terms to 1990, and to make recommendations thereon." On the list of particular items the Commission was charged to investigate and to make recommendations on were "the type, nature and role of the institutions required to meet the educational needs of the province with particular reference to existing institutions and their ability to meet present and future demands", the "facilities required to meet needs, including specialized facilities such as research laboratories, libraries, computer facilities, etc.", and "the need for and nature of centralized or shared facilities and services."

Libraries, of course, have always been among the important facilities required by post-secondary educational institutions and the proliferation of such institutions in Ontario since World War II has entailed the construction of many new libraries, often at very considerable expense. During the same period technological changes, notably those associated with computerization, have begun to revolutionize not only the operating procedures but also the conception of the role to be performed by these facilities.

Prompted partly by these considerations of cost combined with a growing awareness of new technical possibilities, considerable interest has developed during this period in the possibilities of achieving greater efficiency in operation (and also possible savings in capital costs) through measures designed to co-ordinate the provision of post-secondary educational libraries. During the 1960s a number of studies appeared providing information about such developments. [Notable among these were R. D. Downs, *Resources of Canadian Academic and Research Libraries* (Ottawa, Association of Universities and Colleges of Canada, 1967); R. H. Blackburn, *Financial Implications of the Downs Report on Canadian Academic and Research Libraries* (Ottawa, Association of Universities and Colleges of Canada, 1969); Association of Universities and Colleges of Canada, *Standardization in Canadian University Libraries: An Approach and a Proposal* (Ottawa, the Association, 1969); along with many references to the subject contained in more general reports, such as that of the Commission to Study the Development of Graduate Programs in Ontario Universities—the "Spinks Commission".] One of the Commission's concerns, therefore, was to assemble information relating to the development of library facilities in post-secondary institutions that appeared either to be under way or foreseeable in the light of these investigations.

But this was not seen as being the only relevant consideration concerning libraries. The Commission became convinced early in its discussions that libraries of all kinds, and not only those associated with post-secondary educational institutions, had to be considered as important learning resources in their own right. It soon became apparent that much more consideration had to be given to the role of libraries and



other information facilities in the kind of expanded, more open, system of post-secondary education that the Commission envisioned for Ontario in the future.

Both these sets of considerations were incorporated in the specifications drawn up for the background study on libraries subsequently commissioned in June 1971 and now being published here. That is, the objective of the present study was to describe the "state of the art" of library science, to evaluate various alternative concepts for post-secondary library systems applicable to Ontario, to review programs designed to "rationalize" the use of existing university and college library facilities in the province, but also to consider the relation of "public" library facilities to post-secondary education (especially in less populated parts of the province), and to consider the possible role of libraries as community resource centres. It was understood that considerations of time and budget would necessitate heavy reliance upon existing literature, supplemented by selective interviewing and direct investigation in the field.

The contract to carry out this background study was awarded on a competitive tendering basis to the firm of Kates, Peat, Marwick and Company, a partnership which has provided in the past a wide range of professional advice on information systems, planning, and management problems to government and industry. The study was carried out under the overall direction of Dr. Josef Kates who has been involved in the research, planning, design, and operation of modern information systems since the advent of digital computers in the late 1940s. Dr. Kates was one of the key participants in the original University of Toronto computing centre set up in 1948 and is a member of the Science Council of Canada. By a fortunate coincidence, Dr. Kates and the firm's consultant in its Information Systems Planning Group, Dr. H. S. White, have recently been engaged in reviewing a major university library automation project in Ontario and were currently engaged in developing operational specifications for this system. The ability of our contractors to complete this assignment for the Commission in such a short period of time owed much to their recent involvement in such work as well as to their more general background in the field.

The principal findings of the study are summarized in Chapter I. The emphasis in these findings is on the foreseeable impact of technological change upon the operation of Ontario libraries and in particular on the possible efficiencies to be realized through the higher degree of co-ordination of activities that are thereby made technically feasible. The importance of overcoming obstacles to such developments in the form of organizational practices and attitudes of the past is also pointed out. Given the Commission's conception of the future role of libraries as general community information resource centres, these same technical developments are seen to open up particularly interesting possibilities for greatly increasing the amount of information available to anyone within reach of a library linked into the rapidly expanding national and even international information network.

The present study was submitted to the Commission in September, 1971. The opinions and conclusions contained in the study are solely those of the authors, and publication of this study does not necessarily mean that all of the opinions and conclusions contained therein are endorsed by the Commission.

LIBRARIES AND INFORMATION  
STORAGE AND RETRIEVAL SYSTEMS

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Commission on  
Post-Secondary Education in Ontario

October 1971







COMMISSION ON  
POST-SECONDARY EDUCATION IN ONTARIO

LIBRARIES AND INFORMATION  
STORAGE AND RETRIEVAL SYSTEMS

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## I - EXECUTIVE SUMMARY

This section summarizes the major conclusions and recommendations on libraries and information storage and retrieval systems.

### FINDINGS

Our findings are based on a review of previous studies on libraries and information storage and retrieval systems, and our investigation of information requirements of users and operating requirements of Ontario's post-secondary libraries. Our analysis considered the libraries' characteristics, their operating objectives and methods, and required that any changes caused by automation be beneficial to the user and cost-effective.

Briefly, we found:

1. Rapidly Rising Information Requirements  
The information explosion, communications revolution and dramatic increase in the number of users and their requirements are overwhelming traditional library organizations. Library automation appears to be a solution to these rapidly growing requirements. Ontario, with an estimated annual expenditure of \$3 million on library automation, is a leader in this field.
2. Wider Access to Many Libraries  
At present a library user is physically restricted to a single information source. For example, a student at the University of Toronto finds it extremely difficult to obtain information from another library system. In the next ten years, automation systems likely will link together many information centres to enable users to obtain information from an Ontario, Canadian, North American, or even worldwide network with ease.



3. Dearth of Practical Action Programs  
In view of the great need, studies on Ontario libraries have been undertaken. Unfortunately, they have been mainly theoretical and have failed to produce practical action programs for instituting systems.
4. High Cost of Unused Resources  
Materials which have not been catalogued are not available to the user. Ontario's post-secondary institutions contain an estimated \$5-10 million of uncatalogued materials. The annual carrying costs for interest on and maintenance of this unusable resource is estimated to be in excess of \$1 million.
5. Lack of Co-Ordination  
Ontario's libraries have duplicated rather than co-ordinated their efforts in automation. But co-ordination of user needs is vital to library automation in view of its great cost and complexity. Co-ordination has been successful in the United Kingdom where funding of all library automation projects is controlled through a central agency.
6. Duplication of Automated Development  
Several functions, such as a data base at the University of Toronto, a batch circulation control system at the University of Guelph, a Selective Dissemination of Information Service at the National Science Library, and an automated acquisition system at the College Bibliocentre have already been developed. But the efforts of some other Ontario institutions may result in duplicate rather than complementary developments.
7. Feasibility of Sharing Functions  
Although the different libraries vary in requirements and types of users, there are many common functions which can be shared. Such common processes as acquisitions and technical processing have already been shared in at least four other jurisdictions including Ohio, the New England States, California and Colorado.

## PROPOSALS

Our major proposals are as follows:

1. Library Internal Organization Plan  
A general internal organization plan should be developed to serve as a guide for restructuring the internal organization of individual libraries. The plan should develop a library which responds sensitively to the needs of the people who use it.
2. Organization for Co-Ordination  
Co-ordination of library automation systems is urgently required. A possible solution is one single organization that would administer the organizational, financial, developmental, technical and operating structures of library automation systems.
3. Utilization of Uncatalogued Materials  
The inventory of uncatalogued materials must be reduced. Centralizing or sharing of cataloguing resources and data bases and standardizing of cataloguing records, methods and procedures are likely methods for achieving greater utilization. A detailed analysis is required to determine the optimum approach.
4. Utilization of Existing Experience  
Functions such as data bases, circulation control, document retrieval, selective dissemination of information (SDI), machine readable catalogue (MARC) tape services, and automated acquisitions are operating in Ontario. Instead of each library independently re-inventing these functions, more effective utilization should be made of the expertise already developed.
5. Federal and Provincial Roles  
Any overall scheme for co-ordinated development of library automation systems should take advantage of established federal and provincial developmental and financial roles. Additional federal assistance could be forthcoming if libraries could be utilized by all segments of the community.

6. Ontario Corporation for Information

A plan should be developed for an Ontario Corporation for Information which would be Ontario's link in the national information network. The Corporation would link together many information centres in Ontario to provide the user with more vast and effective sources of information.

7. Additional Considerations

In any detailed analysis of library automation systems, the following additional factors must be considered:

- the effects of automation on Library School curricula
- the effects of automation on the employment of librarians
- the design of the library buildings so that facilities and automation are compatible
- the effects of communications on the location of rural library facilities
- the requirements for computer trained personnel on library staffs
- the effects of communications on the selection and location of materials
- the requirements for automation equipment designed specifically for the library environment
- the benefits and costs to be derived by automating a function.



## II - INTRODUCTION

The invention of movable type by Gutenberg in 1476 laid the foundation for the information explosion with which we are now faced. Prior to 1500, Europe was producing books at the rate of 1,000 titles a year; by 1950, Europe was producing 120,000 titles a year. By the mid-1960s the output of books on a world scale, Europe included, approached the prodigious figure of 1,000 titles a day.<sup>1</sup>

The number of scientific journals and articles is doubling every 15 years. Today, the U.S. government alone generates 100,000 reports each year plus 450,000 articles, books and papers. On a worldwide basis, scientific and technical literature increases at the rate of some 60 million pages a year. The volume of printed material is currently doubling every three years and there are no signs that this rate of growth will abate.<sup>2</sup>

During the decade 1960-1970, full-time university enrollment in Ontario has mushroomed from 28,800 to more than 116,000 and faculty members also grew fourfold from 1,830 to 8,000. The 12 universities of 1960 have increased to 16, with a total of 21 campuses. To provide for the dramatic increases in university enrollment, public support has risen from the token \$15 million for operating costs in 1960 to \$327 million in 1970. Provincial funding for capital projects has risen from \$12.7 million ten years ago to an annual total of over

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<sup>1</sup> Alvin Toffler, Future Shock (New York, Random House, 1970), 30.

<sup>2</sup> Ibid., 31.

\$100 million to meet current and projected needs for university buildings and facilities .<sup>3</sup>

Given this background it is not difficult to imagine the problems that must face libraries of post-secondary institutions in Ontario.

The advent of the digital computer, with its unprecedented power for analysis and dissemination of extremely varied types of data in vast quantities and speeds, has potentially provided the library with a tool to deal efficiently with these problems .<sup>4</sup> Many other functions of the library readily lend themselves to automation. With the proper system design, an integrated library information system is possible. Such a system would give vastly better service to the student and researcher since it would incorporate:

- an automatic catalogue look-up facility
- telecommunications facilities to enhance access to library facilities in rural and urban areas
- selective dissemination of information
- greatly enhanced information retrieval facilities which improve the accessibility of information to the user.

In addition, the computer can be applied to improve greatly the administrative functions of the library by:

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<sup>3</sup>Ontario, Department of University Affairs, Report of the Minister, 1969-70 (Toronto, 1970), 9.

<sup>4</sup>Op. cit., 31.

- processing orders for books and serials
- providing check-in control for serials
- increasing the speed of cataloguing information by using machine readable forms
- producing automatically updated book catalogues, card catalogues and acquisitions listings
- controlling circulation
- providing accounting statistics
- providing book utilization statistics to improve the acquisition function
- providing information as to the exact location of any required record.





### III - INFORMATION PROBLEMS OF LIBRARIES

In the past decade libraries have experienced three major changes. First, the volume of printed material is increasing so rapidly that the total material in print will double in the next three years. Secondly, both the number and the sophistication of users have increased markedly; the user now demands more and improved services and many specialized services, and in the case of university libraries, the increase in number of users has been estimated at more than 400 per cent in only ten years. Finally, developments in telecommunications enable many areas to be linked together economically and allow for a greatly increased speed of information transfer.

In these circumstances, it is understandable that libraries throughout the world, and particularly in Ontario's post-secondary educational institutions, are finding that many of the systems and procedures which were adequate in the past, when the volumes handled were much lower, are inadequate to handle today's huge volumes. In addition, many library users, seeking to keep abreast of material relevant to their interests, are demanding improved services in areas such as information retrieval and selective dissemination of information.

Libraries are therefore faced with major problems in developing new systems and procedures to replace those which have been overtaken by the information explosion, communications revolution, and

increase in users. Systems are required to give improved services to library users.

# FUNCTIONS AND PROBLEMS IN A LIBRARY

Traditionally, library organization has been structured on the basis of departmental functions, and accordingly comprises selection and acquisitions, technical services, user services, administration, and computer systems departments.

The Selection and Acquisition Department selects, orders, receives and processes the books and serials. The Technical Services Department classifies, processes and catalogues the material. The User Services Department controls the circulation, and provides reference and other services to the user. The Administration Department controls the personnel and hiring policies, budgeting and accounting for the library. The Computer Services Department attempts to automate individual functions in the library.

Associated with each of these functions are a growing number of problem areas which, for the most part, automation can resolve. Major problem areas of these functions and the ways in which they may be benefited by automation are discussed individually below.

## Acquisitions

Recent years have seen the cost of acquisition services soar to the point where today, the average cost to Canadian universities of



acquiring a monograph is about \$9.00. The cost to Colleges of Applied Arts and Technology is about \$6.00 a monograph and the costs to public libraries are lower but still very significant.

The prime reason for this very large cost is that acquisition services have until recently been very labour-intensive. The sheer quantity of material to be reviewed and to be purchased has created many problems in initiating expediting procedures at the appropriate time, in ensuring that all copies are received, and in accounting for funds.

It is asserted by such organizations as the University of British Columbia, the College Bibliocentre and the University of Guelph that for the majority of acquisitions, automation can be cost-effective in two major areas:

1. In systems to:

- place orders
- control serials acquisition
- follow up orders
- receive materials
- control blanket orders
- control accounts payable
- control general accounting
- produce cost statistics.

2. In shared acquisition systems. Through automation, one central organization can handle the acquisitions of several libraries. One important justification for this is to take advantage of very significant quantity discounts.

### Cataloguing

A book that is not catalogued is not available for circulation. Cataloguing is probably the key problem area of all libraries. Although libraries are reluctant to release exact figures, it is estimated that more than 400,000 books in Ontario's post-secondary libraries are uncatalogued. At a conservative estimate of \$10.00 average cost per item and \$9.00 acquisition cost, there are between \$5-10 million of idle resources in the libraries<sup>4</sup>. The problem of uncatalogued material has resulted primarily from the sheer volume of the material. This volume in turn leads to a need for more complex and sophisticated cross-referencing systems and thus increases the time to create the required bibliographic record.

The results of this backlog in cataloguing are quite significant. Much important material is not available to the researcher in spite of the fact that the material has physically been received by the library. In addition, maintenance cost and interest charges are incurred on material which cannot be used.

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<sup>4</sup>Figures are estimated on the basis of discussions with librarians involved in this facet of the profession.

Automation has greatly improved cataloguing. The Library of Congress of the United States of America provides a machine readable catalogue (MARC) tape service. The cataloguer uses a computer to search the MARC tape to see whether the material he is cataloguing has been previously catalogued by the Library of Congress. If the item is found, the cataloguer uses Library of Congress catalogue information instead of performing an original cataloguing of the item. This reduces the cataloguing procedure from 40 minutes per original cataloguing to a matter of a few minutes for a MARC cataloguing. However, the equipment and computer time involved in the MARC system are rather expensive. The cost of such a system is considerably reduced if many searches are being done. This, of course, implies that many users will use a single MARC system.

Unfortunately, the MARC tapes contain only a small proportion of the catalogue information possible. Accordingly, the computer is also used to store original catalogue information about material the library has had to catalogue itself. If this original cataloguing information is properly structured, the record could possibly become the basic record for Ontario. Therefore, if a book is catalogued once, it should not be necessary for anyone else in Ontario or indeed in Canada to reproduce an original cataloguing for this item.

#### Circulation

Circulation is the process which controls the inventory of the materials in the library. The degree of this control varies with

the nature of the institution. On the one hand, research and large academic libraries exercise rigid control, requiring that exact location and status of the material, the status of the user and the status of the transaction be quickly available to the librarian and potential user. On the other hand, public libraries only require a weekly record of the transactions to control the inventory of materials.

Automation has been applied to greatly simplify and improve the accounting procedures involved in the circulation process. Benefits of these new and improved circulation systems stem primarily from improved control of materials and the provision of statistics on circulation. Emphasis on circulation statistics derives primarily from the need to make the best use of the funds available for acquisition within all publicly funded libraries in a region such as the Province of Ontario. Because the cost of material that could be purchased by any one library far exceeds the monies available for such purchases, even in the largest libraries, librarians are faced with difficult decisions on the selection of materials.

In such a situation, it is wasteful of available funds if many libraries purchase individual copies of monographs and serials for which the combined demand is small. However, such waste is inevitable until effective systems can be developed, first, to identify those types of monographs and serials for which the total demand is low, and second, to ensure that the locations of the copies actually purchased are known to potential users.



The key problem areas in circulation services are, therefore:

- physical control of the inventory of materials and accounting for the transactions
- co-ordination of purchase policies
- identification of low usage materials that can be placed in secondary storage
- increasing the accessibility of bibliographic information from many libraries to the user
- generation of statistics on usage by classification of monographs and serials as an aid to decisions on how many copies should be purchased by whom, and where they should be located
- development of centralized systems for recording and making available the circulation status of individual monographs and serials in each library within a system
- making materials readily available to the user.

#### Document Retrieval

Document retrieval, the process of locating specific government documents, is a problem that has confronted libraries for a long time. The problem today is basically no different than in the past. The librarian still must match the request for a document under many different access points such as subject, title and author. What is changed today is the great increase in the number of documents. Automation has opened up many opportunities to introduce new and effective retrieval methods.

### Selective Dissemination of Information

Selective Dissemination of Information (SDI) is the provision of information to fulfill an individual user's requirements. SDI is performed by defining a user information requirement profile and selecting information from a broad data base to match this profile.

Today with the impact of the information explosion and the increasing degree of specialization in most areas of the arts and sciences, the ability to be very specific in the selection of material is increasingly needed. Thus a very detailed profile of the interests of each user is required, together with very detailed bibliographic information about each book. The matching of user profiles with bibliographic information has become very complex and time-consuming, and new methods are required to achieve this economically. Automation has been proved to have a significant role in SDI and, indeed, commercial SDI services are available.

### Information Retrieval

In many ways this is the most difficult technical problem faced by libraries today. Whereas document retrieval involves locating a specific book or article and SDI involves a systematic matching of complete batches of material to user profiles, information retrieval involves a search for unknown articles or books likely to contain information on narrowly defined subjects. The fundamental problem here is to develop systems which neither miss relevant material nor select too much irrelevant material.

Automation has opened up the possibility whereby a user can actively query an information source through a computer terminal. The user can use the computer terminal to refine his search through successive queries of the information source until he obtains the exact information he requires.

#### Centralization

Throughout this study, a great deal of emphasis is placed on the need for co-ordination and sharing of all library facilities. The concepts of centralization and automation are used almost interchangeably. In fact they are quite different. Centralization is the bringing together of library processes into a shared facility, whereas automation is a method by which this may be done. Due to the large volumes of information and material involved, it is difficult to imagine a practical central library processing facility in which automation would not play a major role.

#### Rural Areas

Great difficulty is encountered in economically distributing information and books to sparsely populated rural areas. This problem is not new but new possibilities of at least partly solving it are opening up. These include the provision of telecommunications to connect rural areas to the main information centres, the establishment of library sub-depots with interactive information retrieval facilities, and the extension of inter-library loan systems.

### CONCLUSION

Fortunately, the information explosion has coincided with major innovations in computer technology and communications, some of which are discussed in the next section. These innovations have created opportunities to provide improved systems and procedures to overcome many of the problems discussed above.



#### IV - TECHNICAL INNOVATIONS

In the past few years, major technical innovations in:

- computer technology
- telecommunications
- methods of information storage

have had a major impact on libraries. Each of these areas is discussed in detail below.

##### COMPUTER TECHNOLOGY

A prime requirement of most libraries is the need to store large volumes of bibliographic information in such a way that rapid access to any of this information can be achieved. In a major library, such as the complex of libraries at the University of Toronto, this means that many hundreds of millions of characters have to be kept in an easily accessible form.

In the past the most effective way of achieving this has been through the use of file cards which can be sorted through reasonably quickly by manual methods. Storage of this volume of characters on computer readable storage media has not been feasible either because of excessive cost or because retrieval times were far too slow. The only method of storing large volumes of information in

easily retrievable forms was the use of magnetic disks similar to phonographic records and these were very expensive.

In recent years, the cost of storing one character of information on a magnetic disk has been dropping rapidly at the same time that access speeds have been increasing. For example, about a year ago, IBM announced the availability of new magnetic disks which allowed about twice as much information to be stored per rental dollar as was the case with previous equipment. At the same time, the average time to get at the information was halved. In addition, other storage devices similar in principle to magnetic disks have been introduced.

Recently Bell Telephone Laboratories announced the invention of a magnetic bubble computer memory. This device, when it becomes commercially available in about five years, will be substantially cheaper, more than ten times faster, and more than a hundred times smaller than any existing computer memory systems.

Changes of this magnitude mean that many library applications can now be economically handled using modern computing equipment. In particular, very large data bases, with more than one million bibliographic records, can be kept available permanently on the computer system with access to any part of the data base within fractions of a second.

#### Printing

Libraries, particularly those with large numbers of foreign books, are faced with a severe problem of printing all the possible

characters which arise in the multiplicity of languages.

Most computer printers use a chain of print which revolves in the computer printer. The required characters are embedded in the chain. The number of different characters that can be included on one machine is severely limited, generally being less than two hundred. This is inadequate to print catalogues which include books in many languages. In the past the only way around this problem has been to have many different print chains available to be changed as required. Such changes resulted in loss of expensive computer time, considerable complications in the design of the computer programs to control the printer, and considerable difficulty in intermixing other languages and English characters.

Xerox Data Systems have under active development a xerographic printer which creates printed pages by a xerographic technique. A xerographic printer can print any character whose image can be created inside the computer memory. Catalogues can be prepared with different languages completely interleaved. The only limitation on the number of different characters that can be used is the size of the computer memory. In terms of the library's needs, this is not a severe limitation.

#### Computer Terminals

A third area of significant development is the increasing ability to link teleprinter type terminals directly to modern computer

systems. It is now possible to enter data directly into a computer from such terminals. The data can include the information updating a data base within the computer or be in the form of questions to be answered from the information already in the computer system. For example, it is possible to ask the computer to give the location and status of a particular book, i.e. who has it, when it is to be returned, whether there are outstanding reservations, etc.

Many terminals can be linked into large computers simultaneously and the computer can respond so fast to a request from any one terminal that the terminal operator feels that he or she has exclusive use of the computer.

#### Computer Speeds

In addition to developments in the areas of magnetic disks, printers and computer terminals, advances are continually being made in other areas of computer technology. In particular, computer speeds are increasing rapidly and the computer programs to manipulate information are also improving. All these advances point the way to increasing automation of many library functions.

#### TELECOMMUNICATIONS

Recent advances in telecommunications which are relevant to the functions of a library include facsimile transmission and the ability to link teleprinter type terminals into computers from long distances.



Facsimile transmission, involving the transmission of complete pages of a document over long distances, has been experimented with extensively. For example, the University of Toronto and the National Research Council in Ottawa combined in a research project to examine the technical and economic feasibility of providing routine transmission of documents required very quickly. Although the costs of the special equipment required are relatively inexpensive - of the order of 6¢ per page - transmission costs are very high - of the order of \$3.80 per page. The reason for this is that the transmission involves the use of broad band lines which require very expensive coaxial cables. Until the transmission costs can be reduced significantly, facsimile transmission will be of very limited value in most library situations.

In the previous section on advances in computer technology, the increasing use of teleprinter type terminals linked directly to a computer system was discussed. In the past most such terminals were normally located in the same building as the computer to which they were linked. This was a result of the need to use transmission lines of a higher grade than those of the telephone system, thus necessitating the use of special private lines. Today, however, standard voice grade telephone lines can be used, and terminals are being linked to computers over long distances using the normal telephone network. The costs of using the lines are simply the standard long distance charges. As a result, there has been a huge growth in the use of computers through terminals located far removed from the

computer site.

This development is of considerable significance to libraries as it allows rapid access to bibliographic data in a central computer system serving many libraries in a large region.

### INFORMATION STORAGE

Advances in methods of storing information in computer readable form have already been discussed. The subject of this section is advances in storage methods in non-computer readable form.

These advances are all linked to improvements in micro-filming techniques and in retrieval systems. Included are extended use of normal 35mm microfilm and the use of aperture cards, microfiche, microdot and random access techniques.

#### Microfilm

The prime advance here has been the introduction of some very inexpensive equipment both to create the original microfilms and in particular to read them. Also many devices have been developed to simplify the process of obtaining quickly and cheaply printed copies of individual frames of the microfilm.

These developments have made it more practical to keep copies of infrequently used monographs and serials on microfilm.

### Aperture Cards

These cards allow a frame of 35mm film to be incorporated in a punch card which normally has additional data punched in it. The punched data allows cards to be selected on the basis of some key such as an index number. The information on the film can then be displayed using normal microfilm readers.

Aperture cards allow the user to search many different documents for the information he requires without searching through an entire microfilm. This greatly enhances the researcher's ability to study information since the researcher may pick a specific page he is interested in.

### Microfiche

Microfiche cards are similar in principle to aperture cards. However, they represent a major advance in that much more microfilmed information can be incorporated in the card. Up to 2048 pages can be compressed into the film in one card. More sophisticated methods of retrieval are needed to handle microfiche cards because of the need to select individual pages from all the pages on one card.

Microfiche cards are the first step toward the day when libraries may cease to store books in their present physical form. With the present information explosion, microfiche techniques may be the only way to preserve libraries from becoming storehouses of enormous amounts of paper.

### Microdot

Microdot is a special form of microfilm which can store considerable amounts of information on a piece of film the size of a dot. Whereas the use of this device has had limited applications in libraries to date, in the future it is expected that wide applications in libraries will emerge, allowing storage of vast quantities of printed information in a relatively inexpensive and small physical form. The microdot may very well be the ultimate means of rescuing the library from massive accumulation of paper.

### Random Access Techniques

Potentially the most significant advance in microfilm techniques has been the application of random access retrieval methods. These methods allow the user to retrieve any documents or page of a book within seconds. Ultimately if all books are put into a random access microfilm form, it would be possible for a user to indicate a specific page in a specific book and have a printed copy of that page before him in a second. Undoubtedly this would greatly reduce the time required by the user to find the material he required and would result in considerably better utilization of user and staff time in the library.

### LIMITATIONS OF AUTOMATION

Automation cannot solve all the problems of a library. It is relatively expensive and requires the services of many skilled



people, many of whom are not librarians. For example, it is estimated that the cost of software development for a MARC system is of the order of \$1 million. Indeed, it is an industry rule of thumb that annual software costs for an automation system are at least equal to, if not greater than the computer hardware costs.

Automation may involve a complex conversion process which is expensive and may result in higher operating costs than the manual system it replaced. In addition, some functions have not at present been automated, and indeed may never be automated. For example, although today it is neither technically nor economically feasible to store the entire contents of all books in the library on a computer or to have an inter-active catalogue which is capable of answering questions on a large data base, ultimately this may be feasible.

However, in spite of these limitations of technology, many functions in the library do lend themselves to automation. When automation can be shown to be cost-effective, these areas should be automated.



## V - STATE OF THE ART OF LIBRARY AUTOMATION

Appendices A, B, C describe the state of the art of library automation in Ontario, the rest of Canada and the world respectively. This section contains a brief discussion of the highlights in library automation.

### ONTARIO

The following observations can be made regarding automation in Ontario's post-secondary information systems:

1. Of the 25 Canadian libraries engaged in various stages of institution of new mechanized technology, 12 were in provincially-assisted universities in Ontario.
2. All 12, involved in similar areas of the application, employed differing techniques and caused duplication in effort and resources.
3. Of the libraries surveyed, only the libraries at the Universities of Guelph and Western Ontario indicated that they had major co-operative programs in automated procedures.

### University of Toronto

The University of Toronto library is the largest library in Canada with approximately 3½ million volumes. The University of Toronto has constructed the largest and most comprehensive library data base in the world. It contains the Library of Congress MARC tapes, the British National Bibliography MARC tapes and the University of Toronto's own original cataloguing. The University of Toronto maintains a MARC tape

searching service which presently has eight users. In addition an on-line circulation control system is under development.

#### University of Guelph

The University of Guelph has devised a computer assisted document retrieval system. This system has significantly increased the productivity of the librarians. A copy of this system is now operating at Queen's University.

A batch circulation control system is operating effectively at Guelph. Similar automated systems are in various stages of operation at York, McMaster and Queen's. In addition Guelph and Western are co-operating in the development of automation systems.

#### College Bibliocentre

The College Bibliocentre is a shared acquisition and technical processing system for the Colleges of Applied Arts and Technology. Currently the only operational co-operative venture in Ontario, it appears to be effectively serving its users and has rationalized costs for these functions.

#### Office of Library Coordination

Organized in May 1970 under the auspices of the Ontario Council of Universities, as the Ontario Universities Bibliographic Centre Project, the Office of Library Coordination has a mandate to co-ordinate library processes. This organization has undertaken many feasibility studies,

however, it has yet to have a major effect on library automation. It is possible that this lack of impact is due to the Office of Library Coordination's apparent lack of power to control the funds of library automation projects.

#### MARC Systems

In Ontario, MARC tape searching systems are operated only at the University of Toronto. Experience in other jurisdictions has shown that such systems are expensive to develop. Presently there are plans underway to develop MARC systems at Guelph, York, Western, College Bibliocentre, Queen's, Carleton, Seneca College, North York Public Libraries and Cambrian College. Obviously, the parallel development of the same MARC facility must be wasteful of resources.

#### CANADA

##### National Library

The National library has plans underway to establish a National Union Catalogue (NUC) based on MARC. At present the NUC does not include Canada's two largest libraries at the University of Toronto and McGill.

##### CAN/SDI

CAN/SDI, operated by the National Science Library, provides a comprehensive SDI service for seven data bases in the sciences. Implementation of MARC tapes will provide SDI for the humanities and social sciences.



### Western Provinces

The University of Saskatchewan's project SELDOM (Selective Dissemination of MARC) provides MARC data profiles for the cataloguing services in many libraries. The Universities of Windsor and York are among the users of this service.

Order and acquisitions, serials control, and batch circulation control systems are operating at the Universities of British Columbia, Victoria and Simon Fraser. Plans are underway to co-ordinate developments among these universities. In general there is little co-ordination of facilities among the eight western universities.

### Quebec

One of the most comprehensive library automation projects has been established at the Documentation Centre at Laval University. Documentation indexes, serials control and batch circulation control have been automated.

### Maritimes

The Nova Scotia government has decided to implement a regional scientific and technical information system and library. This system will link together data centres, public libraries, university libraries, government libraries and industrial libraries to provide users with a larger information base. Dalhousie University, which has had successful experience with automated serials control and acquisitions systems, will be a cornerstone in the proposed network.

UNITED KINGDOM

Library automation in Britain has mainly been concerned with the area of public libraries. Currently more than 25 library automation projects are operating successfully. Part of the reason for the success of British library automation is the Central Office for Scientific and Technical Information which through its control of development funds has been able to co-ordinate the research and development activities. In this way Britain has had considerably less duplication of efforts than most jurisdictions.

Since British book production exceeds that of the U.S., the British National Bibliography MARC project was organized to produce MARC records for British publications. The University of Toronto is the only Ontario institution which maintains a BNB MARC system.

THE UNITED STATES

With notable exceptions, U.S. library automation projects have had a fairly high attrition rate and in general are lagging behind those in Canada. The reason for these failures lies in the American mode for funding projects. Unlike Canada where library automation funds are obtained from operating grants, U.S. projects are funded by special grants. The Council on Library Resources, an agency of the Ford Foundation, has been very inconsistent in granting funds for library automation. Thus, many promising projects have died an early death due to lack of funds.

Library of  
Congress MARC

The Library of Congress Machine Readable Catalogue (MARC) is a system for the central production of machine readable bibliographic material. MARC tapes are used by librarians to assist in cataloguing of materials. The current MARC format was designed to provide the capability to print the contents of the MARC record as 3 x 5 catalogue cards. Although the development of a MARC system is relatively expensive, MARC tapes are utilized throughout the world. In Ontario, the University of Toronto has the only operating MARC searching system.

Co-operative  
Ventures

Although most U.S. library automation is unco-ordinated, there are at least four comprehensive computer-based library networks in various stages of development.

1. California State Library System is a central processing network which is still in the conceptual design stage.
2. Colorado Academic Libraries Book Processing Center is nearing operational status.
3. NELINET, the New England Library Information Network, a centralized cataloguing and technical processing system, is operational. A centralized acquisition system is nearing completion.
4. OCLC, Ohio College Library Center is an operational shared computer facility serving 54 state and private academic libraries. A complete centralized acquisition and technical processing system is being implemented.

### Special Projects

Three projects in the U.S. deserve special mention.

Project INTREX at the Massachusetts Institute of Technology is an on-line interactive catalogue look-up system. This project is in the research stage, but is generating valuable results on methods for automated catalogue searching.

Project BELLREL (Bell Laboratories Realtime Loan) is an on-line circulation control system. It was perhaps the first example of an operational on-line circulation control system in a large library.

IBM's Experimental Library Management System (ELMS) is perhaps the most sophisticated approach to library automation. The complete library system including orders, acquisitions, catalogue, circulation control, serials control and interactive catalogue look-up is automated as a comprehensive system. Although it has not been implemented on a large scale, ELMS is operational at IBM's San Jose, California research library.



## VI - REQUIREMENTS AND CRITERIA FOR LIBRARY INFORMATION SYSTEMS IN ONTARIO

The key objective of library information systems in Ontario is to provide the highest possible level of service to all users within the limits of the available funding. This one objective embraces and implies all other possible objectives, in particular those of eliminating unnecessary, and therefore costly, duplication and of making the most effective use of scarce librarian skills.

### REQUIREMENTS

In developing ways in which this objective can be attained within all the libraries in Ontario which are geared to post-secondary education, consideration must be given to the different requirements and characteristics of the different types of libraries, although magnitudes are dependent on the individual libraries. Some of these requirements are listed below in relative terms for each type of library:

#### 1. Public Libraries:

- handle large volumes of transactions
- use simple form of circulation control
- often have multiple copies of books
- have limited specialization
- require limited bibliographic detail
- serve commercial purposes
- require weekly status on their acquisitions
- relatively small collections.



2. Libraries in Colleges of Applied  
Arts and Technology:

- handle lower volumes of transactions than public libraries
- require more detailed circulation control than public libraries but less than those in universities
- have multiple copies of some books
- specialize to some extent, primarily in technical areas
- require more bibliographic detail than public libraries but much less than the university libraries
- monthly status on acquisitions generally adequate.

3. University Libraries:

- handle lowest volumes of transactions in relation to the number of monographs but have highest numbers of monographs and serials
- handle highest volume of transactions for serials
- require very detailed circulation control allowing for many categories of users with different priorities and for fast recall when necessary
- in general have only single copies of books
- are highly specialized
- require very detailed bibliographic information
- ideally need daily status on acquisitions
- require capability of handling bibliographic information in many foreign languages.

It is clear from this summary that the requirements and characteristics of the different types of library vary significantly. This gives rise to important questions about the degree to which different library services can be integrated between the types of libraries. For example, the amount of bibliographic information required varies from very detailed to quite limited. However, in the case of both the public libraries and the libraries of the Colleges of Applied Arts and Technology, the bibliographic information necessary is only part of the information required by the universities. It would thus be possible to generate the required information for the public libraries and the libraries in the Colleges of Applied Arts and Technology from the records kept by the universities. Whether this would be a reasonable course of action has to be examined in detail to relate the costs and the benefits.

#### CRITERIA

In making examinations of possible alternative ways in which automation could be introduced to the Ontario library system, it is useful to establish various criteria, such as operating costs and levels of service, against which alternatives can be measured. Those alternatives which are best measured against the criteria can then be analyzed in detail. This method allows many alternatives to be examined quickly and ensures the elimination of poor ones without incurring significant costs.

Two types of criteria must be considered: operations criteria and user criteria. However, as previously indicated, the prime criterion should be the level of service provided to the users. This is a broad statement, and must, therefore, be broken down into component parts.

#### User Criteria

##### 1. Accessibility of Information.

This criterion attempts to measure the ease with which the user is able to identify and obtain the particular information he desires.

##### 2. Speed of Retrieval.

This is a measure of the time required for the user to obtain the information or document that he requires.

##### 3. Service of Needs.

A major factor in any library is its ability to service the needs of the users. This criterion attempts to identify the number and types of volumes required and the degree to which special services such as reference or SDI should be implemented.

##### 4. User - Operations Interaction.

Perhaps the most significant criterion to a successful project is the degree to which the user and operations are able to interact. In particular, this criterion attempts to measure how well the library responds to the changing demands of the users.

#### Operations Criteria

##### 1. Reduction of Unnecessary Duplication in Administrative Services.

A major factor in many library automation projects is the degree to which any new system will elimin-

ate duplication, and therefore cost, in administrative services. This criterion is particularly relevant to systems involving the centralization of acquisition and cataloguing services.

## 2. Use of Skilled Librarians.

This criterion attempts to measure the benefit of any system which reduces the amount of routine work which trained librarians are required to do. With the shortage of trained librarians in Ontario today, a major improvement can be realized if they can be freed for those activities most beneficial to users.

## 3. Scope of Inventory.

This criterion is a measure of the depth and breadth of the total inventory of both monographs and serials. Within the limits of total budgets, money can be spent on multiple copies of a limited range of material or fewer copies of a wider range of material. Within the universities in particular, there is considerable merit in attempting to maintain as broad a range of material as possible; how broad is a function of the ease with which the material can be accessed from other than local points.

## 4. Ease of Access.

This is a function of how quickly the whereabouts of a particular book can be established and the speed with which the book can then be retrieved. This criterion could be split into two - ease of access to prime users and ease of access to secondary users where a prime user is defined as some one who is located in the same place as the book.

## 5. Ease of Implementation.

This reflects the relative ease with which alternative systems can be implemented. In particular it is a measure of possible disruption and dislocation to the present system and therefore of service to the users.

## 6. Flexibility in Use.

An important aspect of any new system is to ensure that it does not preclude the adoption of new developments or make them too expensive to implement.

## 7. Compatibility between Different Types of Library.

Because of the different types and requirements of libraries in Ontario, it is likely that many services will be developed separately for each type. A good example would be the development of information retrieval services. However, in these circumstances it is important to maintain as great a degree of compatibility between any systems which are developed.

## 8. Capital Costs.

These are an indication of the costs to implement any alternative system under review. Such costs cannot be precisely determined until a detailed analysis has been made, but the order of magnitude of cost can be estimated.

## 9. Operating Costs.

As with capital costs, it is impossible to determine these costs for a particular system without detailed analysis. Again, the order of magnitude of costs can be estimated.

VII - ATTITUDES AND STRUCTURES IN LIBRARIES

## ATTITUDES

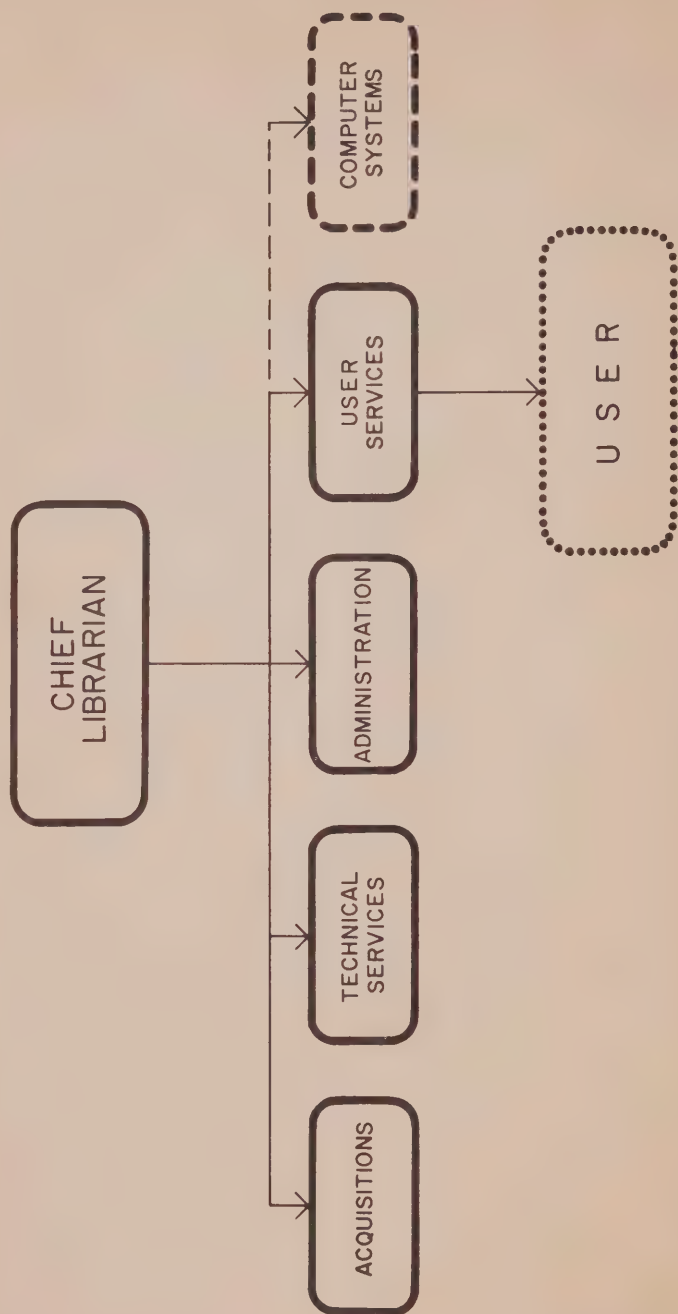
TOWARDS AUTOMATION

Ontario's libraries were established at different historical times using procedures for cataloguing and classification that were in vogue at the time of their establishment. As a result, materials classified in one library have been considered to be incompatible with materials from another library system. This historical fact is manifested in the belief held by many librarians that their particular library is unique and that any system (e.g. circulation control, government document classification) developed elsewhere would have absolutely no application in their library.

In practice, the librarians' belief in the uniqueness of their libraries is not well founded. Although the collections and procedures of each library is unique, all libraries have functions such as acquisitions, cataloguing, technical processing and circulation which are common processes. It has been demonstrated in other countries (U.S. and U.K.) that the automation methods developed for these functions are, with only a few changes, applicable to any library. (See Chapter V). Therefore, it would be difficult for each library to justify the need to develop its own automation methods for these functions.



FIGURE 1  
COMMISSION ON POST-SECONDARY EDUCATION IN ONTARIO  
TRADITIONAL STRUCTURE OF LIBRARIES



#### ATTITUDE TOWARDS THE UNIVERSITY OF TORONTO

Another problem in Ontario is the relationship of smaller universities and the University of Toronto. On the one hand there appears to be a suspicion that the University of Toronto is attempting to centralize all library information functions on itself. On the other hand, the University of Toronto has been preoccupied with protecting internal developments until they reach completion. As a result communications between the smaller universities and the University of Toronto are poor. Considerable benefits would be obtained from an improved dialogue between the smaller universities and University of Toronto. In particular, consideration should be given to the universities of Ontario utilizing both the University of Toronto's experience in automation and its data base. Of course, the University of Toronto would have to be compensated for provision of this service.

#### TRADITIONAL ORGANI- ZATIONAL STRUCTURE

One of the major problems of libraries is that in spite of their inability to handle the vast changes in the information field, the majority of libraries have maintained a traditional pyramid organization structure. This structure, shown in Figure 1 opposite has as its apex the Chief Librarian who rules over the separate departments of book selection and acquisition, technical services, reader services, and administration. In addition, some libraries have added to this structure a computer systems department.

The problem with such a structure is that each department is run as an independent organization. There is little or no communication between departments. The Selection Department is expected to choose material without user requirement statistics. The Technical Processing Department is expected to be prepared to catalogue materials without adequate foreknowledge of the type of materials that it is receiving. The Administrative Section hires personnel irrespective of the needs of the organization. The Computer Systems Department is considered peripheral to the library and is not properly integrated into the library functions. The user in such a structure has the lowest priority. The structure itself is neither responsive to user demands nor flexible enough to handle the ever-increasing volumes of information.

As an example of this lack of response, the Acquisition Departments of many university libraries make no attempt to monitor the circulation statistics. If, on the one hand, the user demand for a particular book becomes extremely high there is no mechanism which will readily inform the Acquisition Department to acquire more copies of that book. If, on the other hand, user demands for books in a particular area became rather low there is again no mechanism for informing the Acquisition Departments to reduce the quantity of books ordered in that subject area. In this case a feed-back mechanism to provide circulation information to the Acquisition System would probably result in a considerable rationalization of university library acquisition budgets.

## SYSTEMS ORGANI- ZATION FOR LIBRARIES

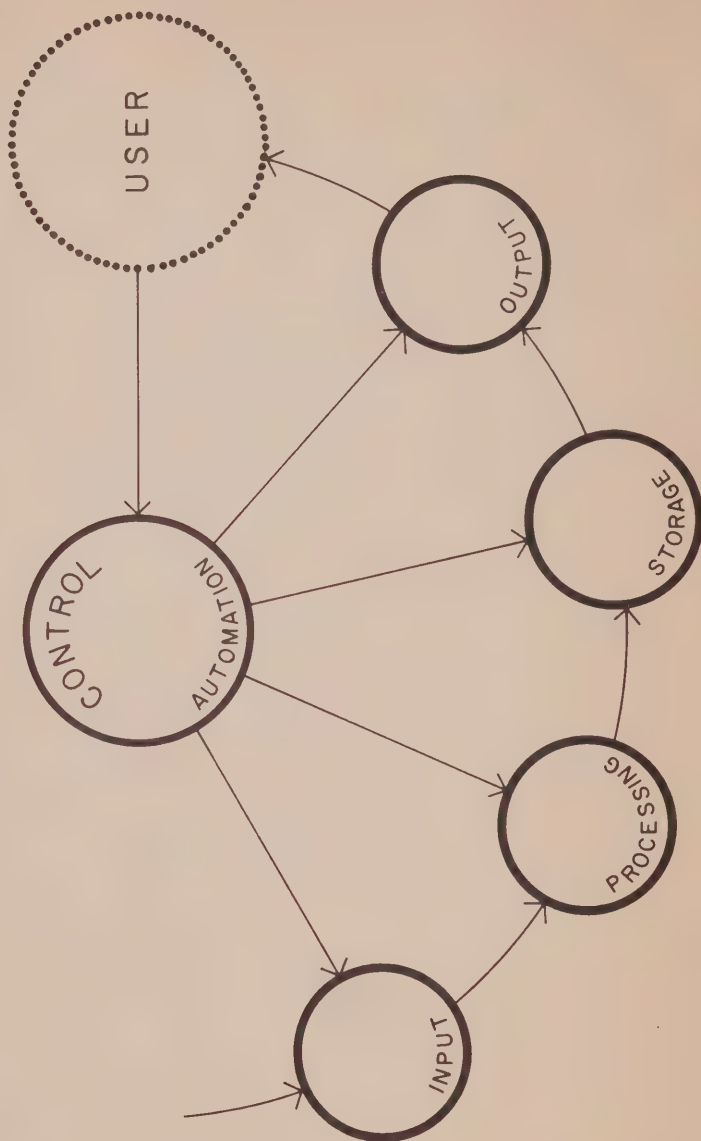
If libraries are to be responsive to the information requirements of the latter half of the 20th century, their organization should be structured on the basis of systems functions, i.e. input, processing, storage, output, and control functions, as shown in Figure 2 overleaf. The system will have as its objective the maximization of services to the user and the maximization of cost/effectiveness of these services.

The input function will consist of the evaluation, selection, and acquisition of materials. The processing function will consist of accounting, announcement of acquisitions, cataloguing and technical processing, and catalogue production. The storage function will consist of the classification and physical storage of materials. The output function will consist of reference services, selective dissemination of information, circulation, and inventory control.

The control function will administer functions by planning and measuring cost/effectiveness and will provide a feed-back of information to the functions on the effectiveness of services to the user. The systems structure would, of course, be responsive to the Planning, Programming and Budgeting Systems (PPBS) approach for the rationalization of library facilities.

In a systems structure the Computer Systems Department would not be a separate organization. It would be horizontally integrated

FIGURE 2  
COMMISSION ON POST-SECONDARY EDUCATION IN ONTARIO  
SYSTEMS STRUCTURE OF LIBRARIES



through all the functions of the library to which automation would provide cost/effective benefits and would act as a link between functions.

The systems structure would contain active links between the functional departments. In this manner the communications problems which exist in the traditional organization will be reduced or eliminated.

The most important level in the systems structure is the user. He should be able to interact to some degree with all functions in the library. In this manner the library will cease to be a storehouse for materials and become a responsive disseminator of information.





## VIII - LIBRARY FUNCTIONS WHICH HAVE BEEN AUTOMATED

In considering the present problems of libraries in Ontario discussed in Section III, certain approaches arise which give promise of improving the information storage and retrieval systems. Although the requirements of the different types of libraries differ greatly, a considerable area of common functional processes can be identified. These are discussed in detail below.

### INPUT FUNCTIONS

A recent innovation in Ontario has been the establishment at the College Bibliocentre of centralized automated acquisition service for Colleges of Applied Arts and Technology. This system seems to be working well and has shown the advantages of this type of centralization. In particular it has:

- insured reduced buying prices through the use of available discounts for buying in quantity
- eliminated the development of separate automated systems by each community college
- apparently reduced the total staff and cost involved in acquisition services.

The establishment of similar shared and automated acquisition services for the universities and the public library should be investigated. The establishment of one shared service serving all types of libraries could also be examined. However, this is less likely to

prove useful because of the quite different buying patterns of each type of library and the different requirements for acquisition status information. Even if this does not prove beneficial, the possibility of developing the same computer system for use in each type of library is worth pursuing. Such a system could well be based on the one already established in the College Bibliocentre for the Colleges of Applied Arts and Technology or in one of the commercial acquisition services utilized by the universities.

In the case of major universities, where a significant proportion of the acquisitions are non-standard items, one can initially envision a two-level approach to the input function. The first level would be to maintain the manual system for the special acquisitions which would not easily fit into an automated system. Automation would assist the manual system in many of the standard accounting functions but it is not expected to supplement it. At the same time a completely automated acquisitions system would be implemented for the more standard items which comprise the majority of purchases. This standard automated package could be the same as that utilized by other acquisitions systems.

#### PROCESSING FUNCTIONS

Also, as indicated on Page V-1, the University of Toronto Library has built up the largest and most comprehensive library data base in the world. The construction of this million record data base has been both an expensive and time-consuming process. As indicated in Section VI

the very detailed bibliographic information required by the universities contains all bibliographic information required by the Colleges of Applied Arts and Technology and the public libraries. If this data base can be constructed in a form that would be useable to many users, then it is obvious that it would be wasteful of public funds to reproduce it for each individual user.

In view of the very high cost of the original cataloguing of individual monographs and serials, any system which can make use of information in the existing data base is likely to provide a major advance.

Two major approaches are possible:

1. Establish separate central data bases for each type of library.
2. Establish one central data base for use by all libraries.

In practice, it is likely to prove more sensible to attempt to make the University of Toronto data base a shared data base for all universities. The feasibility of maintaining this data base at the university or removing it to an organization outside of the university should be studied. In either case the University of Toronto should be compensated in view of the developmental effort it has expended on this data base.

At the same time the viability of extending the use of the University of Toronto data base first to the Colleges of Applied Arts and Technology and then to the public libraries should be considered. Technology of data bases has advanced to a point where it is now econom-

ically feasible to maintain a single centralized data base with multiple users. Using Data Management System (DMS) produced by Xerox Data Systems or Information Management System (IMS) produced by IBM, it is possible for each individual user to obtain the portion of a record that he requires from a single large record. In this manner a centralized data base connected through the telecommunications devices could service all libraries in Ontario.

Figure 3 opposite contains a conceptual view of how such a central data base might be structured. The universities, the Colleges of Applied Arts and Technology and the public libraries would be linked to the central data base by telecommunications terminals. When searching for a bibliographic record, the universities with their large collections would utilize the complete data base, the Colleges of Applied Arts and Technology would search a smaller portion of the data base and the public libraries would search the portion of the data base that they required.

Figure 4 overleaf describes a conceptual view of the actual bibliographic record. The universities would require the complete bibliographic record. The Colleges of Applied Arts and Technology and the public libraries would require smaller portions of this record respectively. It should be emphasized that all three institutions would be using the same record for each item. In this manner all three levels of users could be serviced by a single data base. Obviously a feasibility study of the concept of a shared data base would have to be implemented.

FIGURE 3

COMMISSION ON POST SECONDARY EDUCATION IN ONTARIO

## CENTRALIZED CATALOGUING SYSTEM

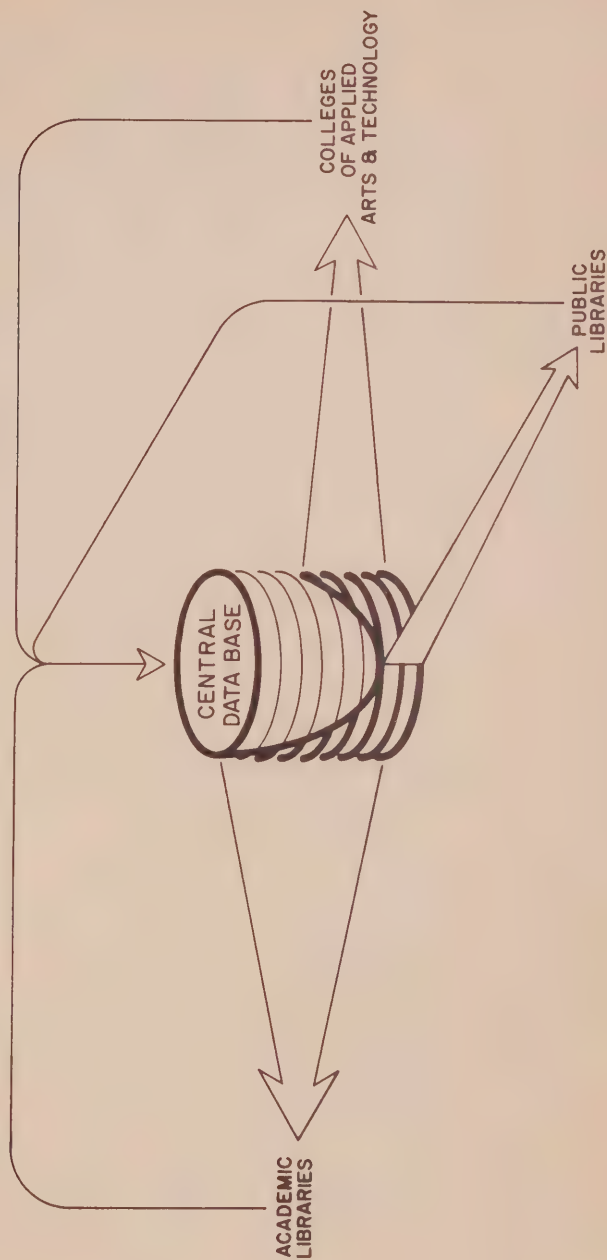




FIGURE 4  
COMMISSION ON POST SECONDARY EDUCATION IN ONTARIO  
UTILIZATION OF COMMON BIBLIOGRAPHIC RECORDS



A subsidiary service that could be provided from any shared cataloguing service is the provision of automatically updated book form catalogues, card catalogues, accessions lists, announcement bulletins, union catalogue lists, and key-word-in-context indexes (KWIC). Since many of these functions are common to all types of libraries, it appears that considerable savings would be obtained by utilization of a shared service.

As in the case of acquisitions services, one can conceive of a two-level concept for the processing functions. At the first level there would be the shared service which would provide the common elements of the processing functions. At the second level the individual library at an additional cost could add its own special processing package to the product of a shared processing system in order to better satisfy its own particular requirements. Ultimately, with the improvement of the shared facility, this second level could be eliminated.

#### Reduction of Unusable Resources

A two-stage original cataloguing procedure should be considered to reduce the large inventory of uncatalogued material. In the first stage, a quick simplified cataloguing would be performed and the material could be placed in circulation. When the backlog of uncatalogued material was reduced, the material could be recalled for a more extensive cataloguing. In this manner the requirements of the users for the material would be satisfied and the expensive unusable inventory would be reduced.

### STORAGE FUNCTIONS

Storage functions are mainly concerned with the classification and storage of materials. With the developments such as microfiche, microdots and random access retrieval devices, significant changes in these areas are expected in the next few years. Ultimately, all materials may be stored in a single compact micro-unit located at a central location. The user requesting a book would obtain either a microfiche or a printed version of the book depending on his desires. This book would be transmitted to the user by means of telecommunications devices.

For the present time the area of micro storage techniques is still under development and relatively expensive. As the level of development increases the costs will be reduced and new uses will be identified to be cost effective.

### OUTPUT FUNCTIONS

#### Circulation Services

Since the data required for circulation control is largely of relevance only at the level of the individual library, it is likely that circulation services should remain under the direct control of each library. The type of circulation control will depend on the particular requirements for service. Academic and research libraries will ultimately require circulation control that is on-line to the computer. Public libraries and perhaps libraries of Colleges of Applied Arts and Technology would probably be able to operate successfully with a

form of circulation known as batch operation. The level to which these two forms of circulation control have been developed in Ontario is described below.

#### Batch Circulation Control

Batch Circulation Control is an automated circulation control system which records circulation transactions, but is not directly connected to a computer. The circulation transactions are recorded on a magnetic tape and this tape is processed daily by the computer in a batch. The processing records the input and output of materials from the library and generates statistics such as fine notices.

The University of Guelph is presently operating a batch circulation control system. Although this system does have a few minor problems such as a 1.5 per cent error rate in the production of fine notices, these problems are due more to attempts by students to countermand the system than to system design faults. In general, the Guelph circulation control system is operating very efficiently and appears to be cost effective.

The staff at the University of Guelph have co-operated with public library systems of Hamilton to develop a similar circulation control system for public libraries. Although we do not have operation statistics on Hamilton Public Library circulation control system, this is an indication that a batch circulation control system is applicable across the broad function of circulation control in all types of libraries.

Considerable effort is being expended in various institutions in independently developing batch type circulation control systems. Since the batch type circulation control systems obviously operates efficiently at the University of Guelph and has been applied to public libraries, the extension of this particular form of batch circulation control to all libraries requiring batch circulation control should be examined.

#### On-Line Circulation Control

On-line circulation control is the ultimate in circulation control. The circulation control system is directly connected to the computer so that it may provide instantaneous reports on the status of the user's, books, and circulation transactions. In accounting for the status of the user, the circulation control system indicates such things as what type of books the user may use, the period he may use these books, and whether or not he has any outstanding fines. In accounting for the status of a book, the circulation control system indicates such factors as whether or not the book has been reserved by another user, the location of the book in the library, and what level of user may use the book. In accounting for the transaction, the circulation control system generates accounting statistics for all books that are out on loan. All three functions are performed instantaneously by the computer and the librarian knows the exact status of every user, item, and transaction at any time.

The University of Toronto is presently developing an on-line circulation control system. A pilot project should become operational in late 1971. When the University of Toronto's on-line circulation control becomes fully operational, it is expected to be the most comprehensive on-line circulation system in the world. If other universities in Ontario require on-line circulation control, the experience of the University of Toronto should be utilized before they embark on such a complex project.

As indicated earlier it is likely that general circulation services should remain under the direct control of each library. However, in order that libraries can easily communicate with each other, the systems used for circulation control should ideally be compatible. This implies the shared development of a system for implementation at each library.

An important aspect of any such system is the ability to generate statistics on patterns of use, which will be of value in determining those locations which should specialize in material of limited interest. This way the number of copies of individual monographs and serials would be reduced, the total number of different monographs and serials increased and the service provided to users improved.

#### Document Retrieval

An automated document retrieval system has been developed at the University of Guelph. This system appears to be operating efficiently and effectively at the small scale university level. However, there

are indications from librarians of some of the larger universities that this system would not be applicable in the larger context. The applicability of the Guelph document retrieval system on a large scale should be investigated. If it is not applicable, it is well worth investigating the common areas between the small scale and the larger scale and to apply the experience of the developments at the University of Guelph.

### SDI Services

Automated selective dissemination of information services have been developed in many locations in Ontario. Examples are the CAN/SDI of the National Research Council and "Quiclaw" at Queen's, both of which are efficiently operating services. The major consideration in the area of SDI is that new services that are being developed do not duplicate already existing services. It may be worth investigating the role of an organization such as the Office of Library Co-ordination in preventing a duplication of such services and in co-ordinating the development of new services.

### CONTROL FUNCTIONS

Several administrative control packages have been developed in industry. These packages contain payroll, bookkeeping, accounting and administrative control functions. There is no reason for the individual libraries to attempt to develop these packages since these are already available commercially and may easily be applied to any library situation.



## OTHER CONSIDERATIONS

### Educational Functions

Any design of automation in libraries would have to consider the relation of the public library facilities to post-secondary education. In addition consideration should be given to the role of public and post-secondary education libraries in the less populated areas of the province. By means of automation and telecommunications it is technically feasible to combine these facilities. It is worth studying whether the combination of these facilities would be beneficial to the users in these areas.

A further consideration is the role of libraries of post-secondary educational institutions as community resource centres, and the consideration of libraries as an extra or para-educational device deserving federal government support. Using automation and telecommunications the availability of information from libraries would be greatly enhanced. It is well worth investigating the degree to which the role of libraries as a para-educational device can be improved by automation.

### Other Jurisdictions

As indicated earlier there are at least four other jurisdictions that have centralized facilities. Ohio College Library Center (OCLC) is a centralized automated acquisitions and cataloguing centre serving 54 community colleges and universities in the State of Ohio. The New England Library Information Network (NELINET) is a similar

organization operating in the New England states. Both systems appear to have generated considerable savings in the input and processing functions. A similar regional system to cover the input and processing functions for Ontario should be investigated.

In Britain, there exists a Central Office for Scientific and Technical Information. This office has the responsibility for co-ordinating all developments in library automation by controlling the funds spent on library automation and preventing duplication of developmental efforts. As indicated earlier there is considerable duplication of developmental efforts in Ontario. The establishment of a similar organization to co-ordinate library automation developments with similar powers of controlling funds should be considered.

## IX - DEVELOPMENT OF RECOMMENDATIONS

Although it is impossible in the limited time and budget of our study to develop detailed recommendations, we were able in a very general way to study many factors. These factors included considerations of the needs of the users, the degree of duplication of developmental efforts, the economics of development, the number of developments which already exist in Ontario, and the developments which exist in other jurisdictions. Some of these further considerations for the development of recommendations are discussed below.

### ECONOMICS OF LIBRARY AUTOMATION

#### Cost of Lack of Co-ordination

An estimated \$3,000,000 is spent annually on automation in libraries in Ontario. Although no exact figures exist, as much as half of this may be spent in duplicating developmental efforts of functions which already are operating in Ontario. If these unco-ordinated developmental efforts are allowed to continue, the unnecessary cost for the duplication of development may double or triple in the next ten years.

#### Cost of Unusable Resources

As indicated earlier, the estimated value of uncatalogued books is between \$5-10 million in Ontario alone. Interest charges and maintenance charges on this unusable material costs Ontario on the order of \$1,000,000 a year. The cost of this unusable resource is sufficient

to justify the investigation of a shared cataloguing service for Ontario. Experience in other jurisdictions such as Ohio and New England has shown this approach to be feasible, however, a feasibility study would be performed on its applicability to Ontario.

### Inventory Control

Experience in other inventory control type operations has shown that the provision of proper statistics can improve the inventory control by 10 per cent to 20 per cent. In the case of libraries, the inventory control statistics would be generated from the circulation control system. These would interact with the acquisitions and selection policy to hopefully bring about a better rationalization for the acquisition dollar. A design study would be performed on the integration of circulation statistics to assist selection policies.

### Acquisitions

As indicated in the earlier section, the acquisition of materials is an expensive process. Considerable savings in the form of discounts for volume purchases have already been generated for the Colleges of Applied Arts and Technology. It is worth investigating the feasibility of organizing a shared purchasing agency for the universities to take advantage of these substantial volume purchasing discounts and to streamline the acquisitions process through automation.

### Conclusions

Our investigations indicate that there are potentially considerable savings to be accrued in the areas of acquisitions of

materials, cataloguing of materials, circulation control, cataloguing of uncatalogued materials, and many other areas. It is worthwhile to identify potential savings and to design the automated systems which will generate these savings.

#### IMPLEMENTATION PROGRAMS

As we have indicated there are numerous studies in progress on libraries in Ontario. At the same time the information explosion has reached such a peak that librarians can no longer manually cope with the volume of information. Librarians are therefore forced to proceed with development of library automation in spite of the fact that these numerous studies are proceeding.

It is apparent that an implementation plan for library automation in Ontario is necessary. This program must be implemented immediately to co-ordinate and rationalize library automation in Ontario.

As mentioned in Section V, an Office of Library Coordination has been organized under the Committee of Presidents of the Universities of Ontario (now the Ontario Council of Universities). This office has been in operation for more than one year and is in the process of performing numerous feasibility studies. It has no apparent financial power over development of library automation facilities in Ontario; therefore, it has had little visible effect on the co-ordination of these projects. The feasibility of establishing an organization similar to the British Central Office for Scientific and Technical Information

with financial powers to co-ordinate and control development of library automation projects should be investigated. The Ontario Office of Library Co-ordination may be a possible vehicle for such powers.

#### Conclusions

The information explosion has gone beyond the bounds which librarians are capable of handling without automation and numerous uncoordinated library automation development projects are underway in the province. Numerous theoretical studies have been performed and are in the process of being performed on libraries in Ontario, but few practical programs have resulted. A Plan must be developed immediately to rationalize the developments throughout the province.

#### ONTARIO CORPORATION FOR INFORMATION

In a recent decision the Nova Scotia Government is implementing a regional scientific information centre and library. This organization would end the restrictions of a user to a single information source by linking together the public libraries, government research establishments, industry and government non-research libraries, university science faculty libraries, and government and industry data banks. The objective of the regional library would be to attempt to better serve the needs of all users by opening up new sources of information and co-ordinating the many different sources to provide the user with a more comprehensive information base.

Figure 5 overleaf, presents a conceptual view of Ontario Corporation for Information. This corporation would link together data banks, public libraries, government and research establishments, industry and government non-research establishments, associations and learned societies, colleges of applied arts and technology libraries, and university libraries.

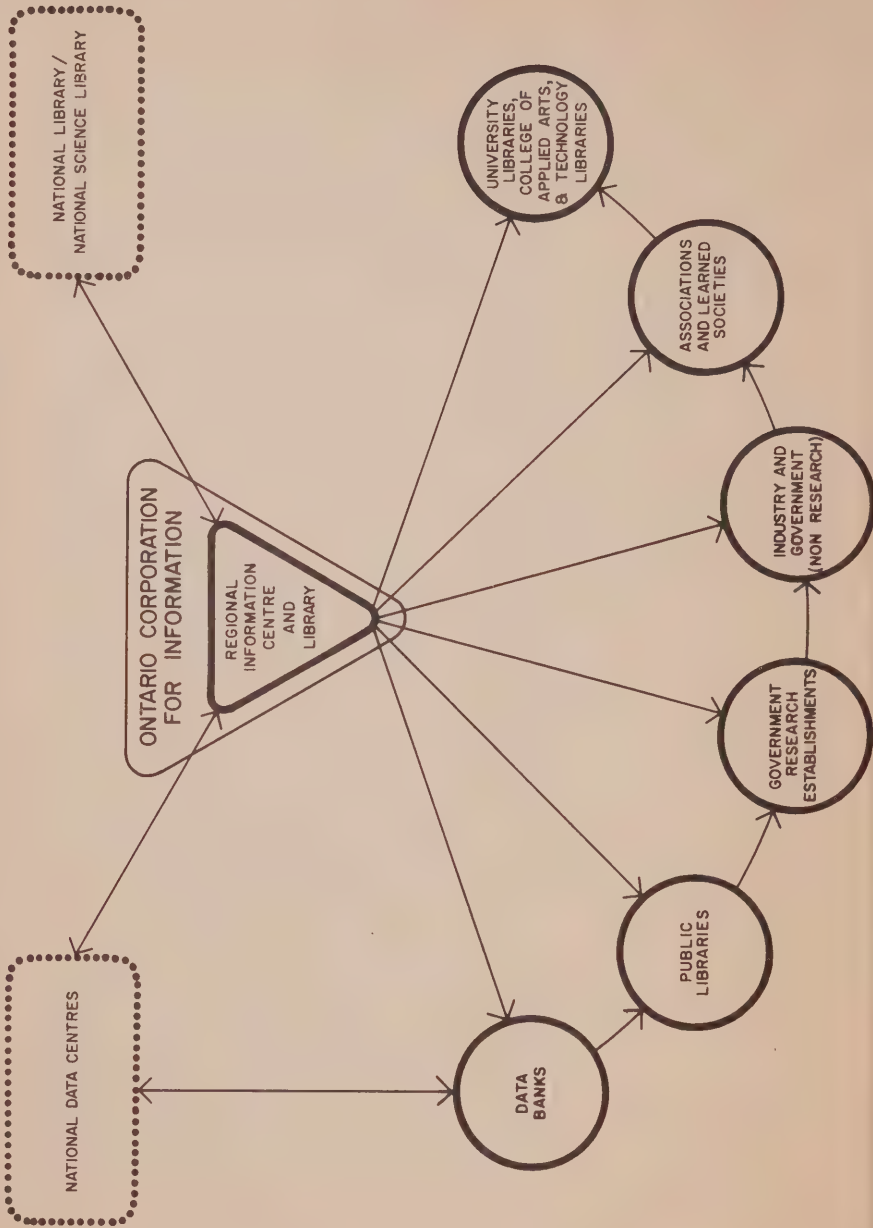
Automation would play the major role in the linking of these establishments. The objectives of the corporation would be to provide all users with the largest, most comprehensive base as a source for the information. Since the libraries of post-secondary institutions tend to be the largest and most comprehensive, these libraries will obviously form the foundation blocks on which any regional information system is built. In this manner post-secondary institution libraries will act as a community resource centre and will provide information for all levels of users throughout the community. In addition, the formation of an Ontario Corporation for Information would allow the libraries of post-secondary educational institutions to be considered as extra or para-educational devices deserving of federal government support.

The conceptual design for the Ontario Corporation for Information shows links with the national data centres, the National Library and the National Science Library. It is likely that the information centre concept will be developed at the regional or provincial level, however, eventually links will be established at the national and



FIGURE 5

COMMISSION ON POST SECONDARY EDUCATION IN ONTARIO  
ONTARIO CORPORATION FOR INFORMATION



international level. Any design for the Ontario Corporation for Information would therefore need to consider its compatibility with a national or international system.

#### CONCLUSIONS

A practical plan for an Ontario Corporation for Information should be investigated. The role of post-secondary libraries in the Ontario Corporation for Information would be included in the plan. Since automation will be the linking force for the Ontario Corporation for Information, it will be beneficial to perform the systems analysis required in post-secondary educational institutional libraries in order that they may be successfully incorporated into any future information corporation.



COMMISSION ON POST-SECONDARY  
EDUCATION IN ONTARIO

LIBRARIES AND INFORMATION STORAGE  
AND RETRIEVAL SYSTEMS

APPENDIX A

STATE-OF-THE-ART OF LIBRARY AND  
INFORMATION RETRIEVAL SYSTEMS IN POST-  
SECONDARY INSTITUTIONS OF THE PROVINCE OF ONTARIO



STATE-OF-THE-ART OF LIBRARY AND INFORMATION RETRIEVAL SYSTEMS  
IN POST-SECONDARY INSTITUTIONS OF THE PROVINCE OF ONTARIO

The 16 university libraries and 20 information facilities of the Colleges of Applied Arts and Technology are at varying stages of planning, programming and implementation of automation projects. Due to limitations of the time and budget of this study, in-depth treatment was given to only 12 of the university libraries, omitting Carleton University, the Royal Military College of Canada, Trent University, Waterloo Lutheran University and the Ontario College of Art. As a result of the investigation of the 12 university libraries, the Colleges of Applied Arts and Technology and activities of importance in the information field, it appears that the following observations can be made regarding Ontario's post-secondary information systems:

1. Of the 25 Canadian libraries engaged in various stages of institution of new mechanized technology, 12 were in provincially-assisted universities in Ontario.
2. All 12 were involved in similar areas of the application employing differing techniques causing duplication of effort and resources.
3. Of the libraries surveyed, only the libraries at Guelph and Western Ontario indicated that they had viable co-operative programs with the other institutions involved in automated procedures.

All the university libraries investigated recognized the urgent need for co-ordination of acquisitions, serials, information retrieval systems, and other types of information transfer; cost-sharing of more effective hardware and the co-ordination of more

qualified staff; co-operation in the building up of specialized collections within the individual institutions; a planning centre for co-operative information organization schemes; and a provincial and/or national union catalogue, of sufficient quality to meet their needs.

OFFICE OF LIBRARY  
CO-ORDINATION

Many libraries are awaiting the benefits to be derived from the Ontario Universities' Bibliographic Centre Project (OUBCP), an administrative unit set up by the Ontario Council of University Libraries (OCUL). As of May 1, 1971, the organization changed its name to the Office of Library Co-ordination, reflecting its more extensive overviews. University librarians urgently need a common compatible data base. Each individual library requires access to a MARC format compatible data base via terminal. The OUBCP recommends the development of a union catalogue of the holdings of the 14 participating libraries in Ontario to be joined with the machine readable union catalogue to be developed by the National Library of Canada. To this end, as of March 1970, close liaison has been established among the OUBCP, the National Library and the National Science Library in order to further joint and compatible developmental efforts and eliminate duplicate expenditures. Whether provincial or national, interlibrary co-operative enterprise requires the establishment of mutually accepted standards of various types. In January 1970, the OUBCP initiated an effort among the 14 Ontario libraries to achieve



standardization of those bibliographic records which would form the basis for union catalogues. This Ontario initiative was extended to the national level by the National Conference on Cataloguing Standards called by the National Librarian in May 1970.

In addition to its plans with the National Library, the OUBCP has established close communication with similar provincial and regional groups with library-oriented services in Canada. The Association of Universities and Colleges of Canada, the Comité de Co-ordination des Bibliothèques Universitaires du Québec, the Inter-provincial Committee on University Rationalization (IPCUR), the Council of Western Canadian University Libraries, and the three university libraries of B.C., as well as with co-operative library organizations in the U.S. and Great Britain. It is estimated that planning for about ten feasibility studies is currently underway investigating areas such as the costs and benefits of centralized services and the encouragement of effective library participation by fostering the exchange of documentation and the meeting of staff on an operating level in order to assist in more effective decision-making or co-operative efforts.

Although these long-range efforts will ultimately be beneficial, implementation will not be operational in the immediate or even medium time frame. While these studies are being reviewed, an endless hierarchy of committees is growing and piecemeal systems devoted to individual library needs are being programmed and implemented.

A brief review of the highlights of the advances in the library and information system automation field at the post-secondary educational level in Ontario will illustrate the above comments. Table A-1 overleaf summarizes the state-of-the-art in Ontario.

THE UNIVERSITY OF TORONTO  
LIBRARY AUTOMATION PROJECT

The University of Toronto Library housing at present approximately 3.5 million volumes has gained a tremendous lead in the compilation of a data base. This data base will contain the complete set of Library of Congress MARC tapes and the British National Bibliography MARC tapes. In addition, the University of Toronto Library has added material from its own collection to the data base. As a result the data base is perhaps the largest and most comprehensive in existence.

To facilitate co-operation among libraries, the University of Toronto Library maintains a MARC tape searching service. This service is available to all libraries and at present there are eight users.

At the present time the University of Toronto Library has operational the Library Outline Data Entry System (LODES). This system is used to capture data on-line for cataloguing purposes.

In addition, an on-line circulation control pilot project should be operational in the fall of 1971. This is the first time that on-line circulation control has been attempted in Canada. This comprehensive system will account for the status of users, books and

transactions. It will record such factors as reserves, fines, priority of user, term of loan, loan status of book, and location of material.

Historically, the University of Toronto Library has been involved in library automation since the early sixties. In 1966, the library had selected, acquired and processed undergraduate material for the five libraries of the Ontario New Universities Library Project. Author, subject and title book catalogues were prepared using data processing equipment. In November, 1966, the library participated in the Library of Congress MARC experimental project.

In summary, the staff at the University of Toronto Library are among the leaders in the world in the areas of data bases, on-line data acquisition and on-line circulation control. Ontario universities should make an effort to benefit from their experience.

#### McMASTER UNIVERSITY

McMaster Mills Memorial Library at present holds about 850,000 volumes; each year more than 60,000 volumes are catalogued. They have implemented a "Micrographic Catalogue Retrieval System", developed commercially by Information Dynamics, in the U.S. Their automated reserve book system gave rise to what they call an "Undergraduate Reading Service" which improves service to the user.

#### UNIVERSITY OF GUELPH<sup>1</sup>

The University of Guelph Library has devised a computer-assisted system for the organization of government publications in a

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<sup>1</sup>Material in this section is based on Margaret Beckman, Documentation System for the Organization of Government Publications within a University Library (Guelph, University of Guelph Library, Research Report No. 2, 1969).

TABLE A-1

STATE-OF-THE-ART OF AUTOMATED LIBRARY SYSTEMS IN  
POST-SECONDARY INSTITUTIONS OF THE PROVINCE OF ONTARIO

| INSTITUTIONAL<br>LIBRARIES  | BROCK<br>UNIVERSITY   | UNIVERSITY<br>OF GUELPH  | LAKEHEAD<br>UNIVERSITY                             | MCMASTER<br>UNIVERSITY   | OTTAWA UNIVERSITY/<br>UNIVERSITÉ D'OTTAWA                         | QUEEN'S<br>UNIVERSITY  |
|---|---|--|--|--|---|--|
| <u>PERCENTAGE OF AUTOMATION<br/>COSTS CHARGED TO LIBRARY</u>                      |   | 100%<br>100%   |  | 100%<br>100%   |   |  |
| Development Costs<br>Programming Costs<br>Operating Costs                         |   |  |  |  |   |  |
| <u>EXTENT AND METHOD OF<br/>MEASUREMENT OF BENEFITS<br/>OF AUTOMATION PROGRAM</u> | 1. Saving Labour Costs<br>2. Accuracy increases<br>service              |  |  | None   |   | Cost/benefit analysis<br>of automated vs manual<br>procedures.   |
| <u>POSSIBILITIES FOR<br/>CO-OPERATIVE ARRANGEMENTS</u>                            |   |  |  |  |   |  |
| Jointly Operated Local,<br>Regional and National Centres                          | Co-ordination of<br>acquisition, cataloguing<br>and serials<br>systems. | Each library must meet<br>its own needs before<br>participating in co-<br>operative schemes.                       | None   | Cost-sharing of more<br>effective hardware and<br>co-ordination of more<br>qualified staff.  | Co-operation with<br>Ontario Council of<br>University Librarians. | Benefits to be derived<br>from Ontario Biblio-<br>graphic Centre (OCUL).                                     |
| Development of a Commu-<br>nications Network                                      | Inter-library loan<br>increase.   | Common compatible data<br>base.  |  | In favour.   | Telex and telefacsi-<br>mle transmission.                         | Increased use of telep-<br>hone and Telex.   |
| Other Arrangements  |   | Exchange of programs.  |  | Co-ordination by a<br>central agency.  | Telex; Inter-univer-<br>sity system; MARC<br>tapes from Toronto.  |  |
| <u>PRESENT CO-OPERATIVE<br/>ARRANGEMENTS</u>                                      | None  | Contact with libraries<br>which have automated<br>systems.   | None   |  |   | None   |
| <u>ADDITIONAL COMMENTS</u>  | 1. Equipment and Man-<br>power limitations                              | 1. Need for equipment<br>designed for<br>libraries<br>2. Manpower limita-<br>tions                                 | 1. Guidance needed to<br>ensure compati-<br>bility | 1. Unsuitable computer<br>2. More systems people<br>3. Increased exchange<br>of information  |   | 1. Need for co-ope-<br>ration to share man-<br>power, program and<br>development costs.                      |
| <u>PRESENT APPLICATION</u>  | 1. Circulation<br>2. Documents<br>3. Serials                            | 1. Acquisitions<br>2. Cataloguing<br>3. Circulation<br>4. Government document<br>and technical<br>report retrieval |  | 1. Acquisitions<br>2. Accounting<br>3. Circulation<br>4. Serials routing<br>5. Accessions Lists<br>6. Special Biblio-<br>graphies<br>7. Cataloguing<br>8. Government<br>documents system | 1. Acquisitions   | 1. Computerized govern-<br>ment document sys-<br>tem (in co-operating<br>with Guelph)<br>2. SDI - "Quicklaw" |

\* No detailed information was obtained regarding the status of the libraries of Carleton University, Royal Military College of Canada, Trent University, Waterloo Lutheran University, and the Ontario College of Art.

TABLE A-1, Continued

| UNIVERSITY OF TORONTO   | UNIVERSITY OF WATERLOO   | UNIVERSITY OF WINDSOR                                     | UNIVERSITY OF WESTERN ONTARIO                   | YORK UNIVERSITY   | LAURENTIAN UNIVERSITY | COLLEGE BIALOCENTRE                                     |
|---|--|---|---|---|-----------------------|---|
| 100%<br>100%  |  |   | 100%<br>100%                                    |   |                       |   |
| 1. Full extent:<br>-measured by technical and administrative judgement  | None   |   |   | 1. Service  |                       | 1. Saving labour and acquisition costs                  |
| Under study.<br><br>Depends on what kind of network is feasible<br><br>Machine readable<br>Canadian Union Catalogue; U.S. National Union Catalogue. | Distribution of MARC data.   | Acquisition of special collections Union.                 | Planning Centre for Ontario libraries.          | Would like access to common data base via terminal.<br><br>Exchange of bibliographic information.<br><br>Co-operative programming for use of MARC II tapes. |                       |   |
|   | None   |   |   | Local Co-operation Exchange of data files, programs and information.  |                       | Serves all the colleges of Applied Arts and Technology. |
|   |  | 1. Central consulting services for library automation.    |   |   |                       |   |
| 1. MARC II data base<br>2. Circulation<br>3. Serials<br>4. BNB MARC data base   | 1. Classification<br>2. Data Files<br>3. Reference lists<br>4. Serials | 1. Acquisitions<br>2. MARC format data base<br>3. Serials | 1. Acquisitions<br>2. Circulation<br>3. Serials | 1. Acquisitions<br>2. Circulation<br>3. MARC II format data base<br>4. Accessions Lists<br>5. Indexing<br>6. SDI<br>7. Reserved Books Lists                 | 2. Cataloguing        | 1. Acquisitions   |

separate collection within the library. Government-sponsored research and technical reports, annual reports of governmental agencies, any published material of a monographic or serial nature sponsored by government funds, technical reports, are included in the collection. A modernized system plan was instituted not only for reasons of increased efficiency of service but for higher productivity. With one librarian to assist in problem areas such as changing names of government bodies, it was found that one clerical staff could code and keypunch 100 government publications titles a day. A department with one librarian and three clerks could expect to process 1,500 titles a week. Guelph has lent its programs for this system to Queen's University Library and the latter's system is fully operating. The University of Waterloo at present, is endeavouring to utilize the MARC IV format in its implementation of the Guelph system but is encountering problem areas.

The Guelph system has a built-in feature as an educational device in that it provides current awareness for research personnel. Much of the literature of research in the fields of science and technology originally appears as technical or research reports. Many of these are not indexed in standard abstracting or indexing tools. Even if they were so listed, the time lag between the first appearance of the report and its citation in an index would cause loss of value in the information contained in the report. The Guelph system for organization of government publications and technical or research reports appears to provide a method which could inform interested users of the availability of publications in their specific fields

of interest even prior to their knowledge of the existence of such reports. Using the thesaurus which would be developed from the key-words in a Key-Word-Out-Of-Context (KWOC) permutation of the title index, research personnel could choose the fields of interest to them. Sophistication of the search criteria would be entirely dependent on economic factors. Each new batch of additions to the collection could be matched (by the computer) with a profile of interests established for participating users. A list of publications of interest would then be printed for individual users, on a weekly or monthly basis .

Other projects involving document retrieval are: Queen's University's Quiclaw service, McMaster's "Reading Service", and York University's business SDI service. Brock University's retrieval system is currently under revision and implementation for a similar system has commenced at the University of Windsor.

#### SERIALS CONTROL

In the area of serials control, the majority of university libraries have undertaken automation programs and have reached varying stages of implementation; some are operational, others partly operating and a few under revision. As early as 1966, Brock University prepared a list of its serials holdings on IBM cards; at this time, the library at the University of Guelph had implemented a serials check-in control



system; the University of Ottawa had issued a machine-produced periodicals list; the University of Toronto was planning for serials control. Currently the University of Waterloo has produced a serials list based on a MARC IV format design. It must be emphasized that many of the titles are the same, many of the subsystems which comprise the total serials effort are similar and there is considerable duplication of effort and expenditure and waste of human resources.

#### OTHER PROJECTS

In the area of acquisitions and circulation control, no clearly defined programs are being followed through. Brock, Guelph, McMaster, Ottawa, Windsor, Western and York are developing acquisitions systems. Attempts are being made by individual publishing companies, in Ontario, represented by the Canadian Book Publishers' Council to provide a standard invoice form and a standard purchase order to facilitate ordering and accounting procedures. Commercial ventures such as the Canadian Library Co. and Book Service of Canada are mushrooming.

As for automated circulation systems, Brock, Guelph, McMaster, University of Toronto, Western Ontario and York have implemented systems, some of which are operating, others, partly and others under revision.

There seems to be two primary complaints - there is a dearth of hardware and software equipment designed to serve library needs;

there is a dire lack of qualified manpower in the libraries. Secondly, individual libraries feel the need to co-ordinate their activities.

#### CATALOGUING DATA BASE

There are indications that there is potentially considerable duplication of development efforts in the area of cataloguing data bases. A data base already exists at the University of Toronto. This data base was constructed using funds supplied by the government.

Surveys indicate that several institutions in Ontario are in the process of attempting to duplicate the same data base. Experience has shown that data bases are expensive propositions which should only be constructed by large organizations. In addition, there are considerable economies of scale to be obtained by extending the services of a central data base to several users.



COMMISSION ON POST-SECONDARY  
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LIBRARIES AND INFORMATION STORAGE  
AND RETRIEVAL SYSTEMS

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APPENDIX B

LIBRARY AND INFORMATION STORAGE  
AND RETRIEVAL SYSTEMS IN CANADA

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LIBRARY AND INFORMATION STORAGE  
AND RETRIEVAL SYSTEMS IN CANADA

NATIONAL SCIENCE LIBRARY

The National Science Library of the National Research Council of Canada has the role of co-ordinator of Canada's national scientific and technical information services network. It has been active in two areas of automation: serials control and selective dissemination of information.

Serials Control

Automation was first introduced in the field of serials control. Starting from a daily current listing of arrivals of 800 journals, the project has assumed the proportions of a Union List of Scientific Serials in Canadian Libraries. This computer-produced list contains the titles, holdings, and location of 40,753 scientific, technical and medical journals received by 225 libraries (university, governmental, industrial and public libraries). Bibliographic data for the Union List is stored on magnetic tapes which are updated frequently to permit daily revision of the master card file. The data is programmed to facilitate preparation of lists of journals held by individual libraries or groups of libraries within a region or a city. Coding used in the preparation of the Union List permits mechanized print-out of lists of serials on the basis of subject, language, country of origin, and type of publication.

CAN/SDI

In 1967, the National Science Library (NSL) implemented a computerized Selective Dissemination of Information Service, the CAN/SDI program. This National Service employs 7 data bases to service 1,400 users from universities, the governmental and industrial spheres.

At present, each user (paying \$100.00 per annum) is alerted to recent papers appearing in approximately 9,000 journals covering most fields of science and technology. This coverage represents at least 900,000 papers per year. During 1969/70, 26,000 tailor-made bibliographies were supplied to SDI subscribers. The NSL subscribes to all journals covered by the six data bases and provides photocopies of all papers upon request. To give some idea of the subject coverage of the combined data base, below is a listing of the available tape services:

1. Chemical Titles.
2. Chemical Abstract Condensates.
3. ISI (Institute for Scientific Information) Service.
4. INSPEC (Information Service in Physics, Electronics and Control).
5. BA (Biological Abstracts) Previews.
6. Bio-Research Index.

Two recently added tapes are currently being integrated into the system: COMPENDEX (Engineering Index), available through the Alberta Information Retrieval Association and the Geological Survey is

working on the American Geological Institute tapes, GEOREF.

As of January, 1969, all data bases have been converted to a modified MARC format. From the technical point of view, introduction of MARC into the system has been a profitable decision. Despite its deficiencies, the CAN/SDI project which has evolved works so well that NSL programs have been acquired and are currently being run by private and government installations in the U.K., the Netherlands, the United States and Canada.

MARC is the standard of the future. Both the International Standards Organization (ISO) and the American National Standards Institute (ANSI) are proposing a format for machine readable information interchange which resembles MARC. The Association of Scientific Information Dissemination Centres (ASIDIC) is recommending to all data base producers that they distribute their information in the proposed ANSI format.

An example of the type of co-ordination of information facilities at the national level is the University of Saskatchewan's project SELDOM, (Selective Dissemination of MARC). The library's Office of Technical Services is using modified versions of the CAN/SDI programs to search on MARC II tapes supplied by the Library of Congress. Effective from March, 1971, CAN/SDI subscribed to the total MARC data base and consequently coverage will increase to the humanities and social sciences, the areas now searched by SELDOM.



To further aid researchers, MARC II tapes, in the near future will include citations to audio-visual materials. Therefore, Canada is in the forefront of building up a comprehensive reference service.

NSL Health Services  
Resource Centre

The NSL Health Services Resource Centre was established in 1967 to provide reference and bibliographic services in the medical and health sciences, to co-ordinate and support the acquisition and use of publications in these areas, and to provide leadership in medical library practice, research and education.

In keeping with these aims, steps were taken to strengthen NSL's holdings of medical journals. All the 2,300 journals indexed regularly by Index Medicus are held either by the NSL or by other libraries in Canada. The NSL, in June 1970, compiled a volume of Canadian Locations of Journals Indexed by Index Medicus.

The NSL, in accordance with an agreement with the U.S. National Library of Medicine has been designated to serve as the Canadian MEDLARS Centre. MEDLARS services form an integral part of the Health Sciences Resource Centre and function co-operatively with the CAN/SDI System. MEDLARS tapes which cover the contents of 2300 of the world's biomedical journals now contain more than one million citations to papers.

Environmental SDI Service

NSL, in co-operation with the National Research Council,

Biology Division, the Environmental Secretariat and other Canadian agencies are at present developing a data base storing documents relevant to environmental quality. Selection was achieved by matching Chemical Abstracts Condensates and ISI magnetic tapes against standard profiles covering broad disciplines such as actions related to pollution standards and criteria, specific pollutants and biological targets. Other tape services related to the quality of the environment will be initiated in 1971.

#### Information Exchange Centre

On July 23, 1970, the National Research Council of Canada, was asked by the Cabinet "to undertake the establishment of an information exchange and to cover all federally supported university research in all the sciences". A Task Force and the NRC Advisory Board on STI (ABSTI) with representatives from various government departments and agencies resulted in the formation of Information Exchange Centre (IEC) which will become operational in the near future. Currently, ABSTI provides guidelines to NRC in the following areas: education requirements for information specialists; general requirements of a national information network; requirements for a technically more advanced future network, utilizing new services and new techniques.

#### National Library - National Union Catalogue (NUC)

The National Library - National Union Catalogue covers about 12 million titles contained in Canadian libraries. The coverage of holdings in Canadian libraries by the NUC is incomplete as the

two largest collections at the Universities of Toronto and McGill are not represented. At present, several plans are being studied for expanding the National Library system. The National Library has recently started to subscribe to the MARC II tape service.

#### PROJECTS AT THE PROVINCIAL UNIVERSITIES

In Table B-1, overleaf, we have summarized the individual library automation applications at the provincial level in the remainder of Canada outside Ontario. Below we provide a more detailed listing of some of the highlights of these projects.

#### QUEBEC

##### Laval University - Université de Laval

##### Serials

- computer list of serial holdings
- annual list of all current serials received
- weekly lists of current serials received
- list of serials subscriptions by renewal date
- lists by library location
- subject lists for library staff.

##### Cataloguing

- created an authority file in French and has devised a system of listing and updating the headings and cross-references
- total of about 18,000 headings.

Documentation - ASYVOL  
 (Analyse Synthétique par  
Vocabulaire Libre) Program

- does not limit the number of terms used by indexers
- this program is used to compile the monthly Index Analytique to 60 French and French Canadian periodicals
- an inventory of 20,000 French university theses
- an index to Canadian Historical Review, 1950 to 1964
- an index to Le Devoir (daily French language newspaper)
- classifying, coding and microfilming millions of documents on every subject of interest to researchers, faculty and students
- microfilm retrieval system and reader-printer
- system can search and locate within 6 seconds any required document from a microfilm file of more than a million entries.

Other Functions

- computerized map catalogue
- Thesaurus to about 3,000 documents in the field of industrial relations
- circulation control.

McGill University Library

- planning automation of periodicals, circulation and order work
- McGill University, Industrial Relations Centre, has a computerized data bank from which the relative data elements of Canadian labour agreements can be retrieved.

TABLE B-1

STATE-OF-THE-ART OF AUTOMATED LIBRARY SYSTEMS IN CANADA

| INSTITUTIONAL LIBRARIES   | UNIVERSITY OF BRITISH COLUMBIA   | SIMON FRASER UNIVERSITY  | UNIVERSITY OF VICTORIA  | UNIVERSITY OF ALBERTA   | UNIVERSITY OF CALGARY  | UNIVERSITY OF SASKATCHEWAN (REGINA CAMPUS)  | UNIVERSITY OF SASKATCHEWAN (SASKATCHEWAN CAMPUS)  |
|---|--|--|---|---|--|---|---|
| <u>PERCENTAGE OF AUTOMATION COSTS CHARGED TO LIBRARY</u>                  |  |  |   |   |  |   |   |
| Development Costs   | 100%   |  | 100%  | 100%  |  | 100%  | 100%  |
| Programming Costs   | 100%   |  |   |   |  | 100%  | 100%  |
| Operating Costs   | 100%   |  |   |   |  | 100%  | 100%  |
| <u>EXTENT AND METHOD OF MEASUREMENT OF BENEFITS OF AUTOMATION PROGRAM</u> | Improved Services  | Cost/benefit analysis  | Planning  | None  |  | Not determined  | Savings in cost of labour and space<br>Added service  |
| <u>POSSIBILITIES FOR CO-OPERATIVE ARRANGEMENTS</u>                        |  |  |   |   |  |   |   |
| Jointly Operated Local, Regional and National Centres                     | Not feasible without accepted standards and system requirements  |  |   | National Centre to help in field of library automation  | Improve access to library resources and information regarding library resources  | IPCUR feasibility study for Western University libraries                                | Shared data base for cataloguing and reference use  |
| Development of a Communications Network                                   | Premature, more development within each institution. Accepted standards in systems requirements  |  |   | Promot location and access to remote circulation and catalogue records                                      |  |   |   |
| Other Arrangements  | Co-operative Systems Design to Establish Agreement for each systems area   |  | Exchange of Information on progress of automation in Canadian libraries   | Standardisation in library automation programs  | Systems analysis, planning and development would be facilitated by access to programs and systems design information for operational systems |   |   |
| <u>PRESENT CO-OPERATIVE ARRANGEMENTS</u>                                  | Quarterly meetings among British Columbia libraries  |  | Quarterly meetings with other B.C. libraries<br>Exchange of documentation   | None  | None   | Use of Simon Fraser University acquisitions systems and that of the Saskatchewan campus | Use of MARC tapes   |
| <u>ADDITIONAL COMMENTS</u>  | Design and installation of specialized systems that provide for unique requirement, this causes duplication of effort  | Decrease duplication of effort   |   | Lack of hardware designed for libraries<br>Lack of skilled staff  | Too few studies; Equipment not adequate for library use; qualified manpower scarce   |   | Limited manpower and finances   |
| <u>PRESENT APPLICATION</u>  | 1. Cataloguing<br>2. Circulation<br>3. Government document retrieval system<br>4. Acquisitions<br>5. Serials<br>6. Use studies<br>7. Accessions lists<br>8. Course reading lists | 1. Cataloguing<br>2. Cataloguing-Maps<br>3. Cataloguing - Pamphlets<br>4. Out-of-Print System<br>5. Acquisitions<br>6. Inventory<br>7. Serials | 1. Cataloguing<br>2. Circulation<br>3. Acquisitions (at systems analysis stage)<br>4. Bibliographic list<br>5. Reserve reading list | 1. Cataloguing (at systems analysis stage)<br>2. Acquisitions (at systems analysis stage)<br>3. Circulation | 1. Personnel records<br>2. Accounting<br>3. Serials  |   | 1. Circulation<br>2. Acquisitions (an on-line acquisitions system will be implemented by March 1973)<br>3. Cataloguing (MARC data base) (planned for on-line conversion)<br>4. SELDOM Project |

TABLE B-1, Continued

| LAVAL<br>UNIVERSITY                | UNIVERSITÉ DE MONTREAL<br>(FACULTY OF SOCIAL<br>SCIENCES)                     | UNIVERSITY<br>OF SHERBROOKE    | SIR GEORGE<br>WILLIAMS UNIVERSITY   | DAHOUSIE<br>UNIVERSITY   | UNIVERSITY<br>OF MONCTON | MOUNT ALLISON<br>UNIVERSITY  | UNIVERSITY OF<br>NEW BRUNSWICK  |
|------------------------------------|---|--------------------------------|---|--|--------------------------|--|---|
| 100%<br>100%<br>100%               |   |                                | 100%<br>100%<br>100%  | 100%<br>100%<br>100%   |                          | None<br>None<br>None   |   |
| labour costs<br>service            |   |                                |   | Improved services  |                          | Under study  |   |
| the field of<br>automation         |   | Canadian Union<br>Catalogue    |   | Programming to use<br>MARC tapes and enlarge-<br>ment of data base             |                          | Would like to partici-<br>pate in regional co-<br>operation  |   |
| to data base                       |   | Telex: transmission<br>network |   | On-line quick response<br>time to specific sys-<br>tems                        |                          |  |   |
|                                    | Will accept any inter-<br>esting co-operative<br>arrangements                 |                                |   |  |                          |  |   |
| e of programs<br>ther libraries    | None  |                                |   | Nova Scotia Council<br>on Library Resources;<br>regional scientific<br>network |                          | None   |   |
| enhment of<br>ds in library<br>ion | Would like to have<br>more reports re:<br>Automation in<br>Canadian libraries |                                |   |  |                          |  |   |
| ject headings                      | 1. Circulation  | 1. Subject headings<br>list    | 1. Serials<br>2. Plans for a com-<br>plete systems ana-<br>lysis and<br>implementation of<br>automated systems<br>wherever feasible | 1. Cataloguing<br>2. Circulation<br>3. Acquisitions<br>4. Serials              |                          | 1. Acquisitions<br>2. Short interval<br>scheduling in order<br>department to be<br>adapted to comput-<br>erization | 1. Indexing<br>2. Long-range plans for<br>circulation, cata-<br>loguing, serials and<br>information retrieval |

University of Montréal  
(Faculty of Social Sciences)  
Library

- circulation system implementation began September, 1969.

University of Sherbrooke Library

- subject headings list under revision.

Sir George Williams University Library

- computer-produced serials list
- future plans for complete systems analysis with automation where feasible and desirable.

Library automation in Quebec is progressing at a much slower pace than in Ontario. However, the seeds have been planted and the libraries, recognizing the benefits to be derived from rationalization, clamour for access to a data base especially Laval.

MARITIME PROVINCES

Dalhousie University

- list of serials holdings
- serials systems, partly operational, between fall of 1968 and 1969
- fully-operational acquisitions system completed in December, 1969.

Dalhousie University Library is a leader in the information field. They are in constant communication with the Nova Scotia Council on Library Resources and participate in a regional scientific network.

They would like to participate in a programming project to utilize MARC Tape and would like to see an enlargement of an accessible data base. They envisage an on-line system achieving a quick response to an immediate request.

Recently, the Nova Scotia Government has decided to implement a regional information system. Dalhousie University will be the cornerstone of such a network.

#### Mount Allison University

- partly operational acquisitions system (implementation completed in March 1970)
- short-interval-scheduling (SIS) in Technical Services of the Library to make projections of future work loads.

#### WESTERN PROVINCES

##### University of British Columbia Library

#### Serials

- list of holdings, information regarding serial subscriptions
- all incoming material will be checked in using a punched card predicted arrival file.

#### Cataloguing

- gave each item accession numbers and keypunched brief entry
- resulting cards used to produce monthly accessions



lists of both catalogued and uncatalogued material to produce cards for filing in a main catalogue, providing access by main entry

- operational since September, 1968.

#### Circulation

- book circulation system since September, 1965
- system used is IBM 1030 consisting of 14 terminals connected to a central punching unit
- transaction cards produced at punch are processed on computer once a day to provide list of outstanding books for each library in the system
- products of circulation system are statistical reports, overdue notices, fines calculations, call-in notices
- historical record kept of all transactions for future use in inventory evaluation and usage analysis.

#### Simon Fraser University Library

##### Acquisitions Systems Design

- captures bibliographic and order information prepared in acquisitions division and uses it for automatic preparation of purchase orders, catalogue worksheets and internal business records
- information revised and used later to produce catalogue cards and circulation book cards.

##### Serials

- list of holdings.

##### Circulation

- IBM 1030 circulating control system, IBM tele-processing system for acquisitions

- fully operational out-of-print system,
- fully operational serials system
- book inventory, fully operating since 1968.

#### Catalogues

- maps, fully operating
- pamphlets, fully operating.

#### University of Victoria Library

- fully operating circulation control system
- fully operating reserve book listings
- the three universities in British Columbia are presently considering consolidating acquisitions and cataloguing functions.

#### University of Alberta Library

##### Circulation

- automation of periodical records and order processes
- circulation system under revision
- systems analysis for acquisitions system started.

#### University of Calgary Library

- implementation of personnel records began in December, 1969
- fully operational serials system
- accounting system completed in May, 1969.

#### University of Manitoba Library

- implementation of circulation system began April, 1970

- acquisitions system began in July 1969.

University of Saskatchewan  
Library (Saskatoon Campus)

Selective Dissemination of  
MARC Information with the  
SELDOM Project

- produces MARC data profiles for various libraries for cataloguing services
- many users of this service including several in Ontario
- costs compare favourably with CAN/SDI service
- March 1971, introduction of all MARC tapes to CAN/SDI,
- future tapes will include all citations for audio-visual material
- MARC tapes will become a foundation of National SDI system for information in humanities, social sciences and arts.

Other Functions

- fully operational circulation system since December, 1967
- catalogue partly operational, implementation planned for May, 1969 - March, 1973
- automatic acquisitions system started in January 1971, based on MARC II information
- an in-house format will be needed for MARC records
- summer, 1971 - IBM 2741 typewriter terminal, on-line data entry and edit.

The University of Saskatchewan (Saskatoon campus) stands out as an example in the concept of library resource rationalization. They

have developed the capability of producing card sets directly from MARC II tapes and extend this service to any interested library. Users would be provided with customized card sets tailored to their specific needs. If a library has its own plans for MARC II, they will provide the needed MARC records in machine readable form on a regular basis at a price below subscription and maintenance costs.

#### SUMMARY

Automation activity in the 8 university libraries of the Western provinces is continually expanding. However, it is developing, as in Ontario, without systematic co-ordination or standardization. The lack of equipment designated specifically for library use, inadequate manpower resources and library automation studies are strongly evident. The libraries are spurred on by the Inter-provincial Committee on University Rationalization (IPCUR) to function at an optimal cost/benefit level. Although some examples of co-operation exist such as the University of Saskatchewan Library (Regina Campus) utilizing the acquisitions system of both Simon Fraser University and its sister campus in Saskatoon, co-operation is minimal.



COMMISSION ON POST-SECONDARY  
EDUCATION IN ONTARIO

LIBRARIES AND INFORMATION STORAGE  
AND RETRIEVAL SYSTEMS

APPENDIX C

LIBRARY AUTOMATION IN THE WORLD



COMMISSION ON POST-SECONDARY  
EDUCATION IN ONTARIO

LIBRARY AUTOMATION IN THE WORLD

STATE-OF-THE-ART OF LIBRARY  
AUTOMATION IN THE U.K.

Although library computerization in the U.K. is but half the age of that in the U.S., the quality, if not the quantity of British research, development, and application has rapidly kept abreast of and in some cases surpassed, American activities. There are two features distinctive of the British automation trend: first, most of the planning has been done in the area of the public library; second, librarians in the U.K. have expressed an enthusiasm for the precepts of automation, in their attempts to achieve inter-library co-operation. As of Spring 1969, there were more than 25 major applications operating routinely with perhaps another 20 being actively developed.

As early as April, 1965, Camden Library, London borough had a computerized book catalogue. In April, 1966, University Library, Newcastle-upon-Tyne, had developed a fully automated acquisitions system and a computerized book catalogue with more than 200,000 entries. Currently, the library has implemented a mechanized serials system.

The University of Essex Library produces computer accessions lists, departmental catalogues and special subject listings. The



University of Liverpool Library produces a computerized listing (7,600 entries) of all its serial holdings, located in 28 libraries, not all of which are university libraries.

In October, 1966, the University of Southampton implemented the first automated circulation system. The Atomic Energy Research Establishment Library, Harwell, has developed an on-line circulation system.

Significant goals have been achieved at the West Sussex County Library. In April, 1969, a computerized book catalogue comprised of 25,000 entries had been produced to serve the library's 20 branches. At present, although both experimental and operational, it is the only library to have on-line access to its circulation file.

The British National Bibliography MARC project has developed a pilot project involving the distribution of BNB MARC tapes to 20 British libraries and the University of Toronto, similar to the MARC II project in the U.S. Since British book production exceeds that of the U.S., it has doubled the size of the pool of machine readable catalogue records available at the present time.

The Bodleian Library, Oxford, consisting of 129 separate libraries, has used BNB MARC tapes in its development of a book catalogue which will place a union catalogue of Oxford's holdings in each of the separate libraries. It is predicted that the Bodleian Library will have converted 1,250,000 entries to machine readable form by 1973.

The British Museum has programmed Oxford's KDF-9 computer so that British Museum machine readable records are compatible with the MARC II format.

The libraries of the Atomic Weapons Research Establishment, City University, London Technical College Library and the Atomic Energy Research Establishment Library, have computerized alphabetical subject indexes to their description schemes or to their classified catalogues.

British libraries are in the forefront of co-operative developments. An example is the Union List of Periodicals in Institute of Education Libraries which has employed the Newcastle file-handling system. U.K. libraries are taking advantage of the new technology to improve service to users at all levels. Part of the reason for the success of British libraries is the Central Office for Scientific and Technical Information. This organization is responsible for all grants for libraries and library automation. It co-ordinates the research and development activities to ensure that there is no duplication of efforts. Since it controls all funds for development, it has been able to ensure the maximum benefit for the research investment.

THE STATE-OF-THE-ART OF  
LIBRARY AUTOMATION IN  
THE UNITED STATES

Library automation in the U.S. has reached a relatively high degree of excellence; however, the position of the U.S. is inferior to

that of Canada because of the American mode of funding library projects. The Federal financing agent, the Council on Library Resources, grants monetary resources in a sporadic manner. The initial capital outlay may be more than adequate, but money for operating expenditures over a longer period of time is scarce. Consequently, many a promising development in the field has been abruptly curtailed for lack of money.

Library automation in the U.S., excepting a few noteworthy cases, has, as in Canada, developed in a fragmented, piecemeal manner, lacking cohesion and co-ordinated direction. Below is a listing and a short commentary on several outstanding library automation developments.

#### Library of Congress MARC

In February, 1966, the Library of Congress launched Project MARC (Machine Readable Catalogue). This development of the Library of Congress Central Bibliographic System was an experiment to centrally produce machine-readable data that was recorded in a standardized format on magnetic tape, and to test the suitability of this data for local use. Sixteen libraries, of which the only Canadian representative was the University of Toronto Library, were selected. Each library received, on a weekly basis, a complete bibliographic listing of MARC data. The output formats were designed to provide the capability to print the content of the MARC record as 3" x 5" catalogue cards.

In 1968, a standardized MARC II format was adopted and tapes, the product of more sophisticated technological "know-how", were more widely distributed. Currently, at approximately \$1.13 per card set, catalogue card sets, spine labels, and a punched book card for circulation purposes are produced. The Library of Congress maintains an SDI service based on MARC print-out by classification range.

Recently, four new developments have increased service for the subscribing libraries: a newly added data element which allows for MARC records to be computer-filed in library filing sequence expedites timely production of national union catalogues; non-English Roman alphabet language records have been added; cross-reference structure records are included; bibliographic records for motion pictures and film strips have been integrated into the system.

Data bases founded upon subscription to MARC-II tapes are being built up, not only in the U.S., but in Canada, Germany, Sweden, Great Britain, Japan and the U.S.S.R.

#### Project Intrex

Project Intrex, at the Massachusetts Institute of Technology Library started late in 1965 as a research program in augmented catalogue look-up and subject retrieval. These innovations are aiming to construct on-line, direct-access computer memories containing the bibliographic data.

Computer processors organize and search the data in storage.

User access to the system is by means of visual display terminals equipped with light pens. A number of basic operations can be performed on textual matter. While the physical document is the input to the system, 150-word pages can be displayed on the face of the console; selected passages of text can be named and stored for future reference.

The director of Intrex envisaged the on-demand copy service as one which could be diffused to all parts of an academic community so that no person would have to move far from his office or laboratory in order to reach a local terminal of the library network. The user would find an electronic display console on which he could consult the library's union catalogue. For deeper bibliographic searching, a teletypewriter keyboard would give him inter-active access to a central computer facility with a large store of indexed information on journal and report literature. The libraries would be interconnected to form regional and national networks. Implementation is still in progress at M.I.T. but the rate of activity is slow and painstaking.

#### Project Bellrel

An on-line, real-time computer circulation system has been in use by the Technical Information Libraries of the Bell Telephone Laboratories since March 1968. In its initial configuration the BELLREL (Bell Laboratories Real-Time Loan) system links two terminals in each of the company's three largest libraries - at Holmdel, Murray

Hill and Whippany, New Jersey - to an IBM 360-40 computer at Murray Hill. The system is designed to process loans, returns, reservations and a range of information queries with real-time immediacy and responsiveness; in addition, batch operations provide multiple reports and other products necessary for the effective control and management of the system. During the first year of operation with not all the total collection complete on disk, BELLREL handled over 105,000 loans and 250,000 transactions (i.e., loans, returns, reservations, and queries) in real-time.

#### IBM - ELMS

IBM, under the direction of Dr. I. A. Warheit, has developed an Experimental Library Management System (ELMS). ELMS is perhaps the most comprehensive development of an automated library system in operation anywhere in the world. ELMS performs on-line order and acquisitions, catalogues, serials control, document control, circulation control and perhaps most impressive, interactive catalogue searches. ELMS is operational at the IBM research library at San Jose, California. However, at the present time, IBM is making no concerted effort to develop ELMS as a commercial package.

#### IBM - Other Developments

IBM's Systems Development Division Laboratory at Poughkeepsie, New York has been engaged in library automation activities for several years. The punched card circulation system dates back to 1959, and the first computer-produced printed book catalogue appeared in 1961. In

1964, all book acquisitions and processing activities, including cataloging were brought together into the Library Processing Service Department to serve several IBM libraries.

IBM has developed a total systems concept, integrating the IBM Administrative Terminal System (ATS) with more common computer techniques to perform library processing services for a multi-library network in a scientific and technical environment. Emphasis is placed on acquisitions and cataloguing functions but other applications such as circulation and announcement preparation, abstract and text writing, editing, communications and statistical record keeping have been designed. The program package, used for index creation and 3" x 5" card printing, has been in service since 1963.

IBM has effected a direct man-machine communication procedure through on-line, real-time, multi-programmed typewriter terminals directly connected to computers. These terminal systems permit the operator, whether he be order desk clerk, catalogue reference librarian or typist, to interact with the computer in manipulating data stored within it.

#### New York State

New York State has been near the forefront of co-operative developments in library automation applications. The total amount of state aid in New York exceeds that of the other 49 states in the United States combined. In 1966-67, a network of institutions was established to send and receive facsimiles of documents and pages

of books to libraries anywhere in the state. Participants included the N.Y. State Library, N.Y. Public Library, Cornell University, Buffalo and Erie County Public Library and Rochester Public Library.

A user-oriented, on-line, real-time, computerized library system was being developed by the State University of New York at the Upstate Medical Center in Syracuse which would link the three libraries of Medical Center Library. The network was expected to make it possible for clients to search the list of recent medical books and journals available in the participating libraries in less than two minutes by means of computer input-output terminals. The list was to include approximately one million items published in the last five years. At the present time, it appears that this program has been cancelled due to a lack of funds from the granting agency.

#### U.S. Co-operative Ventures<sup>6</sup>

Currently, there are four comprehensive computer-based library networks which are in various stages of development.

1. California State Library processing network, which is still in the conceptual planning stage.
2. Colorado Academic Libraries Book Processing Center, which is nearing operational status.
3. NELINET, the New England Library Information Network which is in operation but not fully implemented.
4. OCLC, the Ohio College Library Center, is in operation but not wholly implemented.

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<sup>6</sup> Material in this section is based on C.A. Cuadras (ed.), Annual Review of Information Science and Technology (Chicago, American Society for Information Science, 1970).



These networks seem to be moving toward direct access to files that would be kept on-line but as of 1969-70, the mode of operation would be batch.

California State Library System

The California State Library has commissioned the Institute of Library Research of the University of California to design a processing center. Although the State Library would be the original user, it is anticipated that other libraries may become participants in the network without administrative or geographical limitations. The first phase in the system includes conversion of bibliographic records to machine-readable form, production of book catalogues for subscribing libraries and serials control. Later phases will include acquisitions, interlibrary loan and development into a technical information center.

New England Library  
Information Network

The state university libraries of Connecticut, Massachusetts, New Hampshire, Rhode Island, and Vermont are the present participants, but NELINET is envisioned as a regional system, eventually capable of serving any New England library.

Early in NELINET's development, the decision was made to begin with the area of technical processing, giving initial attention to cataloguing. Additional services contemplated include acquisitions, union lists, book form catalogues, circulation and interlibrary loan

control, library management information, and remote data base interrogation.<sup>7</sup>

Cataloguing is based on MARC-II and the system provides for procedures for extracting data to create catalogue cards, spine labels, etc. Basic cataloguing techniques are modified to suit the individual needs of each participating library.

The NELINET experience has shown that computerized systems can accommodate many different processing practices with little expense of human effort. Since it is possible to program a system which can accommodate almost any variation, the question of what to standardize and what variations to allow becomes a question of economics, not of technical feasibility. Allowing variations does involve additional machine-running time to operate the system. The additional programming time is a one-time expense; the additional running time is not.

The libraries participating in the development of NELINET are university libraries. With the exception of using Library of Congress catalogue copy and cards, university libraries have not entered into co-operative or centralized arrangements to any extent. That five libraries have been willing to accept products in some respect different from their own is indicative of the co-operative spirit and realistic attitudes of the librarians involved.

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<sup>7</sup> Dewey E. Carroll, Proceedings of the 1969 Clinic on Library Applications of Data Processing (Urbana, Ill., University of Illinois, Graduate School of Library Science, 1970), 35.

Ohio College Library  
Center (OCLC)<sup>8</sup>

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OCLC is a centralized computer facility similar in concept to NELINET but has a wider membership (54 state and private academic libraries). It was incorporated in 1967 to increase the availability of library resources for use in educational and research programs in colleges and universities throughout Ohio.

OCLC is a non-profit corporation chartered by the State of Ohio. Its members, at the present time, pay to the center an assessment based on the number of books that each member library added to its collection during the previous year. Each member institution appoints a representative to the center, and the representatives elect from their group nine trustees (three each year for three-year terms) whose responsibility and authority are the same as those which most corporate trustees possess. The Ohio State University has generously made available space to house the center's operations.

Activities of the Center are research, development, implementation, and operation of computerized systems to achieve the center's academic objectives and economic goals. Although relatively little time is expended on research, most of which is separately funded, there is a great need for research activity to produce the knowledge necessary to develop regional library systems.

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<sup>8</sup>Material in this section is based on Frederick G. Kilgour, "A Regional Network--Ohio College Library Center," Datamation (February 1970), 87-89.

In the summer of 1971, the MARC-based data system became an on-line operation. The on-line shared cataloguing system is based on a central computerized catalogue that will also form the data base of the other four sub-systems. Shared cataloguing will speed the cataloguing process and reduce cataloguing costs in member libraries:

1. By taking advantage of cataloguing performed elsewhere and thereby eliminating duplicate effort
2. By employment of labor-saving machines.

In addition, this sub-system will include, at no extra cost, a central union catalogue whereby each member can rapidly determine by author and title the location of materials throughout Ohio.

The second project will be an on-line remote catalogue access and circulation control system, which will enable faculty and students, while outside the library, to check local institution holdings as well as holdings throughout the state. Access to this system will be by author and title, as well as by call number of a book. This system will inform the user of the location of the item desired, and whether or not the item is immediately available for him, before he leaves the building in which he is working or studying and from which he generated his inquiry. This system will greatly reduce user costs, which must be included in library system costs, as well as cut costs to libraries for circulation control.

The Ohio State University libraries have signed a contract with IBM to design and activate a remote catalogue access and circula-

ation control system that will be similar to the center's sub-system. It is the intent of OSU that its system design will be such that the center will be able to take advantage of it by adapting at least modules, if not the entire design.

The third system will be a retrieval project that will enable users at remote terminals to search the central catalogue by subject, by title alone, by any author (should there be multiple authors), and by editors. This system will be capable of carrying out searches using post-co-ordination of subject words, title words, and names.

The fourth project is a serials (periodicals, annuals, year-books, etc.) control system that will facilitate library control of serials holdings, and user access to these detailed records.

The fifth sub-system will be a major library technical processing system that will computerize most of the library acquisitions and catalogue-processing activity. One of this system's major products will be the addition to the central catalogue of materials in process so that a user can determine the existence and location of a specific book in a library system before complete entry in a catalogue has been accomplished.

It is hoped that the Ohio College Library Center Regional Library System will be a prototype node in a national network. However, as soon as three or more nodes exist, it will be necessary to establish some national library authority to manage the network, particularly the

switching of messages among nodes. To date, the Ohio College Library Center has done no specific system design for such a network, but its adherence to national standards will facilitate national implementation when nodes become operational in other regions.

#### EDUCOM

The Council on Inter-university Affairs has founded EDUCOM, a consortium of some one hundred or more universities and colleges, whose specific goals are to establish automated library services, information networks, programmed instruction and a nationwide television network. EDUCOM operates the Educational Information Network (EIN) which is a mechanism for sharing computer programs among member institutions. It publishes a software catalogue which currently contains 140 programs and is updated and expanded every six weeks.

#### OTHER COUNTRIES

The Federal Republic of Germany, in 1966, was the first country to produce its national bibliography by computer. Recently, a modified MARC II format was adopted. Further, computerized book catalogues have been produced at the University of Bocham.

Italy, Sweden, and the U.S.S.R. have all developed MARC II tape formats designed to suit individual country requirements.



COMMISSION ON POST-SECONDARY  
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LIBRARIES AND INFORMATION STORAGE  
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APPENDIX D

BIBLIOGRAPHY





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